Vol. 25 NOVEMBER, 1904 No. 147

THE FOUNDRY

PUBLISHED MONTHLY BY
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CLEVELAND, OHIO.

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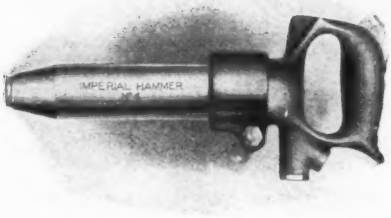

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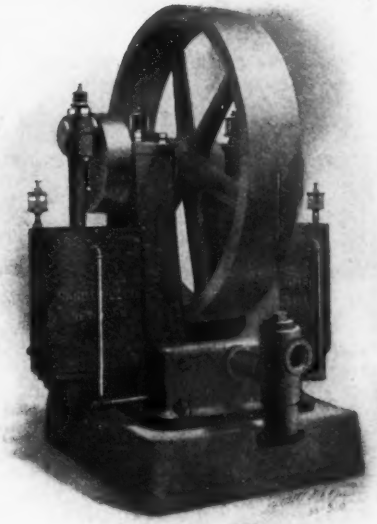

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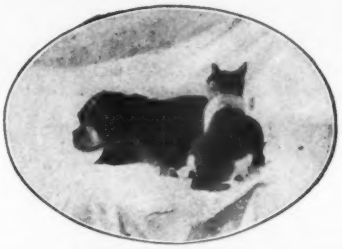

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R. H. THORNE, Chairman.

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Power Transmission Machinery,
Gray Iron Castings.

WILLIAMSPORT, PA., Sept. 10th, 1903.

The Williamsport Chemical Company,
Williamsport, Pa.

GENTLEMEN:—In reply to yours of the 4th inst., regarding my opinion of "Croil," would say that I have given it every possible test here in the Foundry, have found it to be the equal of Linseed Oil, and the superior of any Core Oil or Compound that I have ever used.

Yours very truly,
J. J. CALLAHAN,
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It makes a strong, smooth core — is one-third cheaper than linseed oil — one-half cheaper than flour — produces less gas (most of it comes off in the baking) — in fact the best compound ever made.

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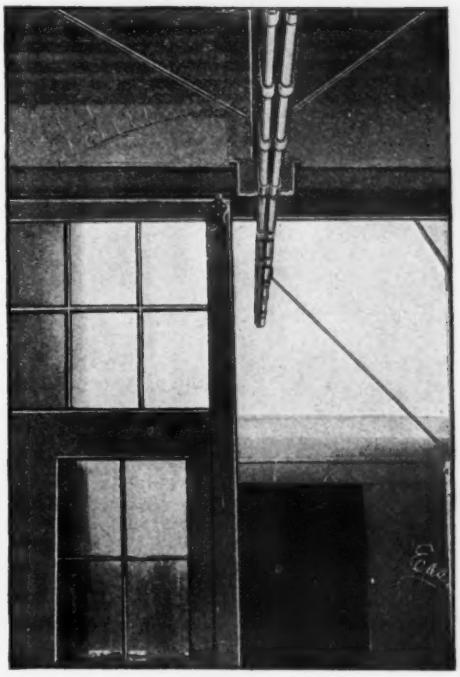

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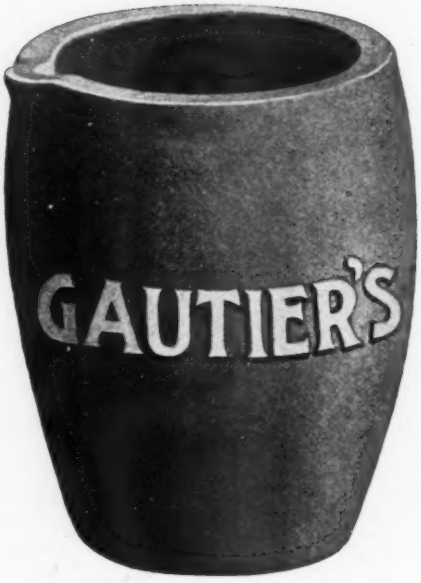

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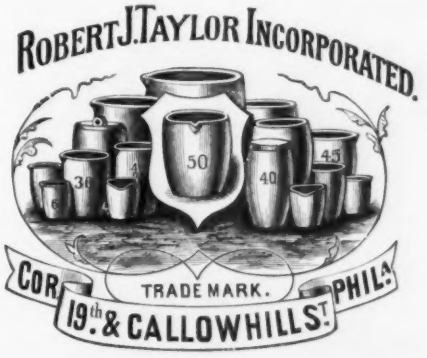

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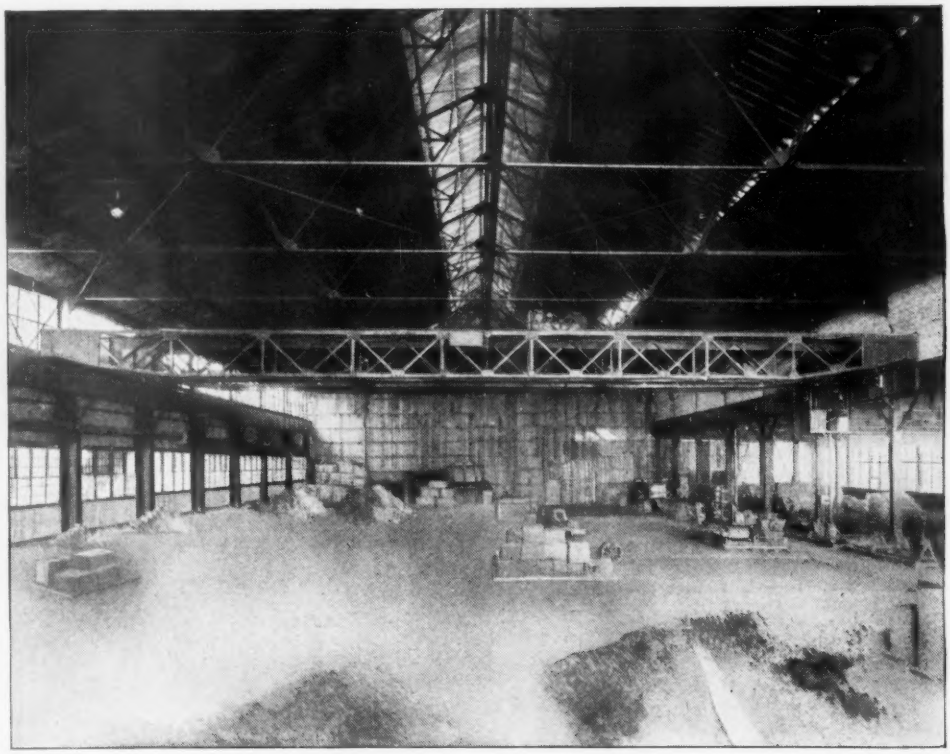

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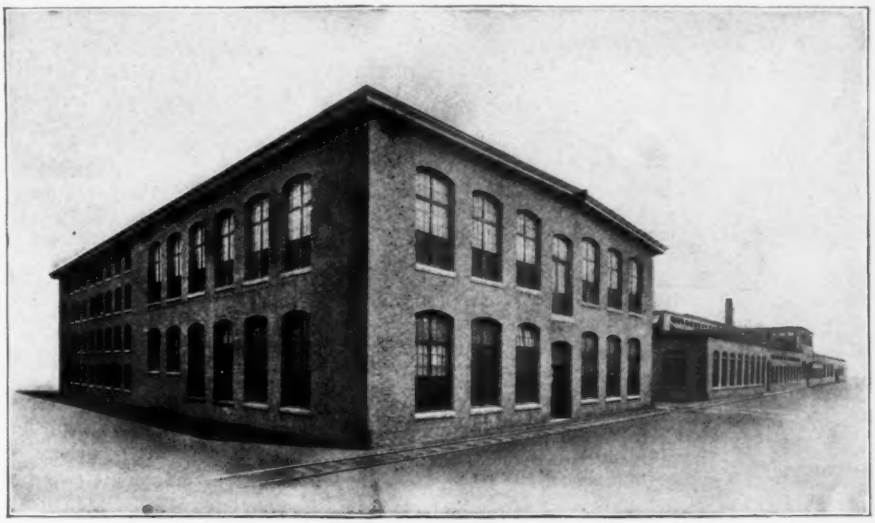
THE FOUNDRY

Vol. 25, No. 3. *CLEVELAND, OHIO, NOVEMBER, 1904.* *Whole No. 147*

Pattern Shop of the B. F. Sturtevant Co., Hyde Park, Mass.

In November, 1903, we published a description of the foundry of the B. F. Sturtevant Co., at Hyde Park, Mass. Foundrymen are also concerned in the matter of keeping track of patterns, pattern production, records, etc., and we print herewith a description of the pattern shop, pattern storage, and system of handling patterns of the B. F. Sturtevant Co. In the article above referred to, it will be remembered that the ground plan of the arrangement of the works was printed, in which a plan of the works was shown, and that the pattern shop was located across one end of the foundry, at a distance of about 40 ft. from it. Two lines of industrial railway, which extend through the length of the foundry, enter the pattern building, one passing into the flask shop and the other into the pattern storage.



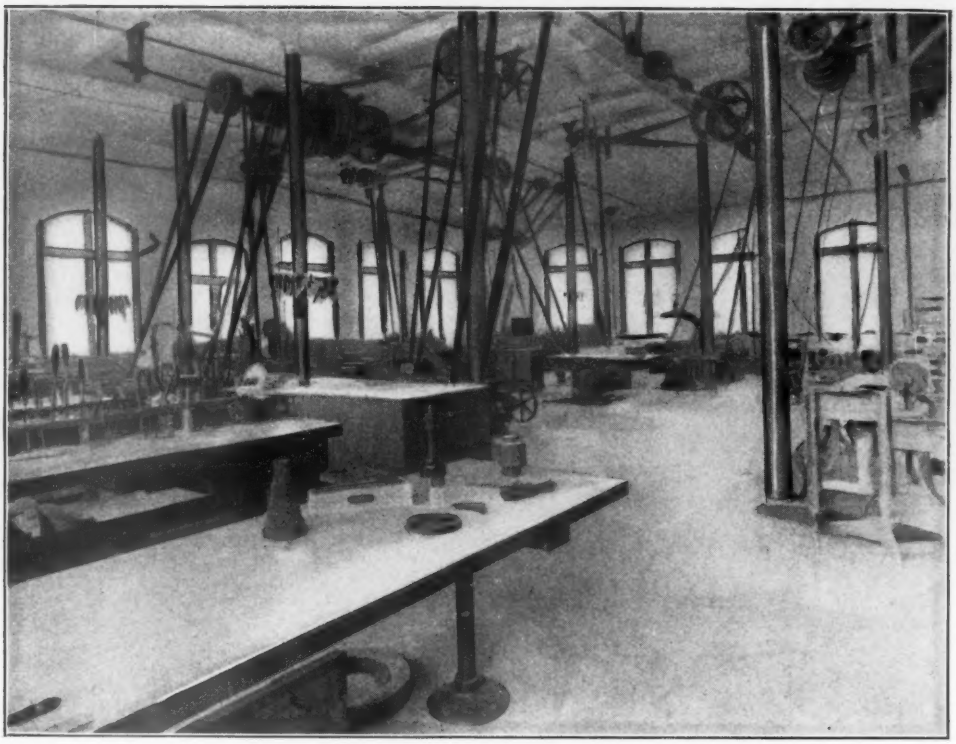
PATTERN SHOP AND PATTERN STORAGE.

The pattern building proper is divided midway of its length by fire walls, which enclose the stairs, elevators, etc. One-half of the building is arranged with two stories, the lower one 17 and the upper one 15 feet in height. This portion of the building is devoted to the flask and pattern making departments, while the other half is provided with intermediate floors, making four in all, and is utilized for pattern storage.

The flask shop is 60 by 80 feet, and is equipped with band, cross cut and splitting saws, boring machines and lathe. All of these are driven by a 10-horsepower Sturtevant motor suspended from the ceiling. The industrial railway runs directly into this room from the foundry, which is only 40 feet away. There is also an overhead trolley system, which reduces the work of handling the flasks to a minimum. The lumber for the manufacture of flasks is unloaded from cars directly in front of the building.

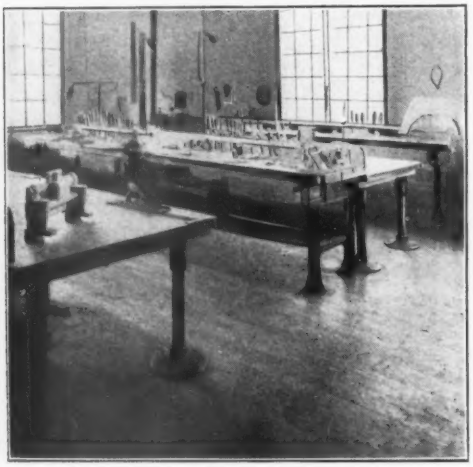
The machinery and equipment for the metal patternmakers is also located in this room, and the lockers and wash rooms for the building are adjacent thereto.

Immediately above the flask shop is situated the pattern shop. It is abundantly lighted, having windows on three sides, and is equipped with a full complement of tools, including



WOOD PATTERN SHOP.

one single and two double saw benches, two band saws, a buzz planer and surfacer, five lathes, one of which is a 66-inch by 11½-foot

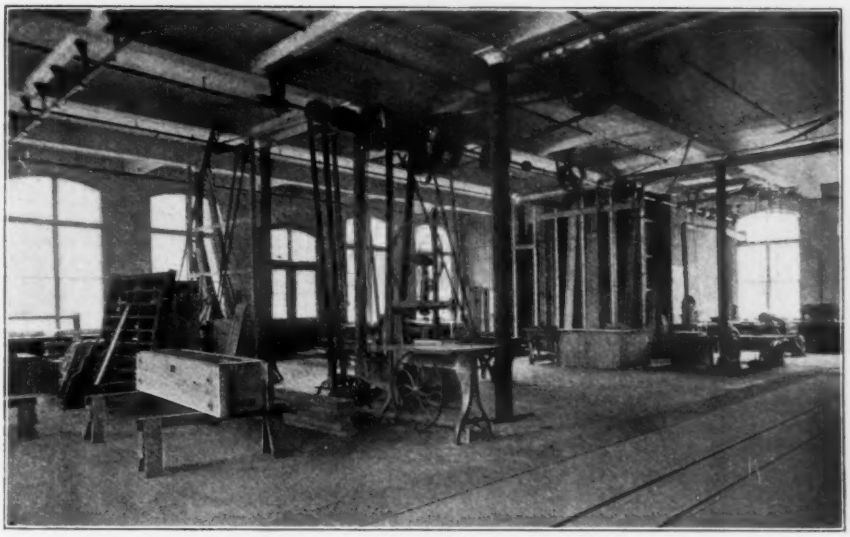


WORK BENCHES.

gap lathe. Also a drill press, a corebox machine, numerous wood trimmers, etc. All of the machines requiring power are operated by two 10 h. p. Sturtevant motors, both being used ordinarily, but either one serving as a relay in case of accident.

The benches were designed and made by the B. F. Sturtevant Co., and contain a number of interesting features. Each bench is 16 feet in length by 2 feet 6 inches in width and is intended to accommodate two men. The benches are arranged along the sides of the building, so that each man receives light over his left shoulder. Specially designed cast iron legs are used to support heavy maple tops. The benches are provided with Emmert vises and suitable drawers for holding tools. Behind each bench there is a working table 4 feet wide by 16 feet long, the working table being a few inches lower than the benches. These working tables are of very simple construction, the legs being made from cast iron flanges and pipe.

A drying chamber for glued work is provided and arranged to receive warm air from the general heating flue connected with the Sturtevant heating apparatus below. In addition to the elevators for moving work from the upper floors, double doors have been provided on each floor of the pattern building, so that large pieces can be handed out through them, a beam extending from the roof serving



FLASK SHOP.

as a support for a suitable hoisting rig for handling such pieces.

Pattern Storage.

The first floor of the pattern storage end of the building is provided with a concrete floor and is intended for keeping the heavy cast iron patterns. It is served by an industrial railway and turntable, which permits the transfer of patterns to different parts of the floor and to elevators connecting with the upper floors. The connection between the pattern shop and the pattern storage is direct, but the fire risk is reduced to a minimum by a double system of fire doors.

The pattern shelving is supported upon brackets clamped to the columns in such a way that they can be arranged at any desired height. Shelving is also used along the walls for the storage of small patterns.

System of Handling Patterns.

When a new pattern is to be made the pattern number is assigned in the drawing room and entered upon the drawing, these numbers being consecutive. Patterns for gray iron castings are given numbers without a prefix. Patterns for brass castings have numbers preceded by o. Those for steel castings have numbers preceded by oo, and so on, different prefixes being used to designate different materials. As the drawings are made, these numbers are taken off by the draftsman, and recorded in a blotter having columns for date, pattern number, name of pattern, and drawing number. This record is afterwards transcribed into the pattern record book by the record clerk in the drawing room.

When the pattern number is being entered in the pattern record, a pattern cost card like that shown in the accompanying illustration is made out. This card is sent with the drawing to the foreman of the pattern shop, and is an order for him to make the pattern described. The time is kept in the pattern shop and entered on this card, as is also the record of the stock used. When the pattern is completed it is inspected by the pattern shop foreman, who signs the cost card and enters the

NO. 16489 7½ 14x8 V.C. 6 Engine Frame 4125-A

Name	No. of Part	No. Pcs.	Name	No. of Part	No. Pcs.
Main Pattern			Core Boxes		
Sweep	2		9		20
Mould Board					
Loose Pieces					
Dwg. No. 6-1462					

PATTERN RECORD CARD.

METAL PATTERNMAKING DEPARTMENT.

date completed. The pattern is then sent at once to the pattern storage, which is under the supervision of the pattern foreman, and the pattern card is returned to the drawing room, where the cost is figured up by the recording clerk. The item of expense is obtained by keeping a record of the total labor in the pattern shop and the total material purchased for the pattern shop. When any work other than pattern work is done a record is kept of the time and material and the pattern shop is given credit. These records give the amount of material and labor to be charged to expense. To this is added a certain amount for depreciation and fixed charges. The whole is then distributed by a percentage which is added to the hours of pattern labor.

When patterns are delivered to the pattern storage department, proper locations are assigned and records thereof made out upon cards like that shown in the accompanying illustration. These cards are filed in the order of the pattern numbers. Four figures, with the addition of a letter, are in every case sufficient to locate a pattern. A given location, for instance, may be 2125B, that is, upon the second floor, as shown by the first numeral 2. It is in the twelfth row of shelves and the fifth division of that row, as shown by the succeeding numbers 12 and 5, and on the B level,

PATTERN COST CARD. PATTERN NO. _____

NAME OF PATTERN _____

ORDERED _____ 190 DRAWING NO. _____

WANTED _____ 190 ORDER NO. _____

MATERIAL	QUAN. STOCK	PRICE	AMOUNT

NO.	WORKMAN'S NAME	HOURS	RATE	

COMPLETED _____ 190 TOTAL STOCK AND LABOR _____

INSPECTED EXPENSE _____

TOTAL COST _____

_____ FOREMAN

PATTERN COST CARD.

PATTERN STORAGE.

the floor level being designated by A, and the letters B, C, D, etc., indicating the shelves in their order above.

When the foundry foreman receives an order for castings from the office, he issues to the pattern storage department an order for the pattern, upon a properly filled out blank, one of which is shown in the accompanying illustration. It will be noted that the front of this is the order proper and the back is devoted to a record of the castings made. This card is made out in duplicate, one copy going to the pattern storage keeper, who upon receiving it refers to the index of patterns and finds in the upper right hand corner of the card the location of the desired pattern. He then records this upon the casting order and attaches the casting order to the pattern for delivery to the foundry. At the same time a metal clip is placed upon the pattern record card to indicate that the pattern has gone to the foundry. The other copy of the casting order is sent to the clerk in charge of the cleaning room, who daily re-

Pattern No. 13326 Order No. 9249

Location 2098 E Total number Required 24

Name of Pattern 3 M P H Pole Shoes

Date Issued July 6, 1904 Date Returned

Moulder Weight

Deliver to

FRONT OF CASTING ORDER BLANK.

CASTINGS MADE.

Date	Good	Bad	Date	Good	Bad
7/12/04	4		Forwarded		
7/19/04	7				
7/22/04	5				
7/23/04	3				
7/25/04	5				
Total			Total		

BACK OF CASTING ORDER BLANK

cords on the back the number of good and bad castings made from the pattern, and keeps the molder informed as to the number of castings required to complete the order. This little device serves to guard against over-production and has one advantage in that the entire matter is in the hands of one man and that no bookkeeping is required on the part of the molders themselves.

When the required number of castings are made, the pattern is returned to the pattern storage and the metal clip taken off from the pattern record. The two copies of the casting order are then returned to the foundry office, one by the man in charge of the cleaning department and the other by the man in charge of the pattern storage. The receipt of one shows that all the castings are complete and shipped to the shop, while the receipt of the other shows that the pattern has been returned to its proper place. After this one of the casting orders is destroyed and the other is retained in a file in the foundry office.

MECHANICALLY MADE CORES.*

In the production of good castings, nothing is of more importance than the cores. The core must not only form the inside of the casting but must be strong enough to resist the pressure which comes upon it without springing or breaking and at the same time must be porous enough to vent freely. Many attempts have been made to produce duplicate cores by mechanical methods. These methods can all be divided into three classes:

First, those which depend upon sifting or shoveling the sand on to a rotating arbor and then striking it off to the proper form.

Second, those which depend upon the method of ramming the sand into the mold or form, either entirely by machinery or partially by machinery and partially by hand.

Third, machines which form the cores by causing the sand to flow through a properly formed orifice under a steady and uniform pressure.

The first class is used very largely in the making of pipe cores and other loam cores, and for this purpose has been found very successful, as it is not a matter of ramming in the loam core but a matter of getting the soft loam in place and properly formed for baking, the loam being so soft that it will flow readily; hence cannot be rammed hard in the sense of ordinary tempered sand. This same method has been used to some extent in the making of green sand cores, in which the sand is sifted or shoveled on to the arbor and swept off with a strickle board or sweep. Cores made in this way, either from green sand or loam, always require some facing or blackening, and green sand cores are liable to be very irregular in density at different points, resulting in irregular venting and frequently with the accompanying results of scabs and bad castings. At present there is no machine in general use in this country for making small cores operating upon this principle.

Under the second class, we find a number of types on the market. For the making of short cylindrical cores a stripping core box is in quite common use, especially in Europe. This consists of a plate having one or more holes of the required diameter and fitted with a plunger or plungers for stripping or forcing the cores out of the holes. In this case the cores are rammed by hand and subsequently stripped out by forcing the plungers up, usually with the foot lever. Such a device as this has two disadvantages. First, if a permanent or fixed vent wire is used, the ramming must take place about this; hence the wire is very liable to be bent or crowded out of shape and in drawing through the core is liable to disturb the interior of same. If no venting device is used, the cores are naturally ventless. Second, it is only possible to make short cores in this manner, as the surface friction would prevent the stripping or forcing of a long core from the box, and it would also be impossible to ram a long core evenly. The forcing of these cores out by means of a plunger would naturally tend to make the lower part more dense than the upper.

Other machines have been devised in which a reciprocating plunger is used to force the sand through the form for producing a long or continuous core, but it will readily be seen that every time the plunger retreats it must leave an impression of its face upon the sand, and as more sand is crowded in front of it a parting would naturally be formed in the core. As a consequence, a machine of this style cannot produce a continuous solid core.

The third class of machine must of necessity be fed by some device which will crowd a continuous and unbroken stream of sand through the die, and the only successful device we know of for accomplishing this is a screw, and the machine is of the well known sausage mill type. It looks like a very simple matter

*Paper read by George H. Wadsworth before the Philadelphia Foundrymen's Association at the September meeting, 1904.

to put a screw into an ordinary form and force material through a die to give it the desired form, but it must be remembered that sand is an aggregation of extremely sharp pieces of mineral matter and, when mixed with a bond, as in the core mixture, it is neither fluid nor even semi-fluid, and as a consequence no small amount of skill has been required in dealing with such a mixture. The successful development of a core machine of this type has only resulted after the solution of many little, but important, problems. It is now possible to produce not only cylindrical cores but cores of any prismatic section, and of considerable length, by this means.

The question of a vent through the core is quite important. The first suggestion would naturally be to introduce a short point on the screw and let it leave its own vent, but this point is constantly rotating and is subject to a very peculiar scour by the sand as it leaves the screw and takes its course into the die. As a result, such a point is soon worn out of true and finally destroyed. It has been found that better results can be obtained by having a hole through the center of the screw and using a stationary vent pin passing through the screw and its shaft and held in position from the outside of the machine. As the core is rotating, the wear upon such a pin is uniform at all points; hence it always remains in the center and always produces a true vent, but one of the very unexpected results with this style of vent has been that the pin is worn very slightly indeed. In this connection, while considering the matter of wear it may be interesting to state that it was natural to suppose at first that the core machine dies would be cut out very rapidly indeed by the sharp sand, but to our surprise it has been discovered that the wear of the dies is very slight and that they maintain their size and shape almost indefinitely.

The matter of the feeding of the material into a machine of this type is of importance, as it has been found that a screw must be supplied with material no faster than is necessary to supply the amount of sand for the core being made. If the screw is buried under a large amount of sand, it simply cuts out a cylindrical form, the top becomes bridged over and the screw ceases to feed sand forward.

This type of machine was first used for cylindrical cores and it was found that the core as it came from the machine had a slight rotary motion. The rotary motion resulted in a very smooth surface upon the core and, as oil is used for a binder, the result is a very smooth surface which requires no blackening or slicking. When it was finally decided to make prismatic cores, it was first supposed that the surface would not be as good as in the cylindrical cores, but by very careful arrangement of the dies it has been found that the die surface gives practically as smooth a surface in the prismatic cores as in the cylindrical.

For grinding any material, that is, for abrading its surface with an abrasive, it is necessary that the abrasive be set in some bond which will hold its cutting edges firmly in position while they are doing the cutting. In the case of core sand in a relatively large body being forced through a machine, the individual grains are to a large extent free to move among themselves and, as a consequence, the moment a sharp corner comes in contact with the metal face, the grain has a tendency to rotate about this point and place itself with a flat face in contact with the metal surface. A soft die, or a relatively soft die, is undoubtedly better for this purpose than a hard one, on account of the fact that it gives the grains a better chance and grip for turning. This movement of the individual grains results in a very smooth surface which, when baked, is hard, smooth and porous and also results in a very little wear on the die. A similar action undoubtedly takes place about the stationary vent pin and greatly reduces the wear upon it.

The best cores that it is possible to make in a machine of this kind can be produced from a mixture of silica sand, flour and oil. The silica sand should be clean, sharp and free from loam or clay, but as practically all founders use a local bank or lake sand, experiments were made with this class of material and it has been found that very good cores can be produced from any good sharp sand, free from loam or clay, when mixed with the proper proportions of flour and oil. The oil used in most cases has been boiled linseed, but it is probably true that with some sands other core oils may be found valuable. The material is worked drier in this machine than in hand ramming, in fact it would be totally impossible to make a good core by hand from the material when properly tempered for use with the machine.

In this connection, it may be of interest to say that some very interesting experiments were tried recently with the use of loam and bank sand without any oil or flour whatever.

A mixture of one-half ordinary swamp loam and one-half bank sand is used. This produces a very porous core, having an exceedingly good surface, and a core which drops out or can be cleaned out very easily, as the loam burns out and leaves the core very free. The one point necessary in using such a mixture as this is to be sure to have ample provision for carrying away the vent, as considerably more gas is generated than with ordinary core mixtures.

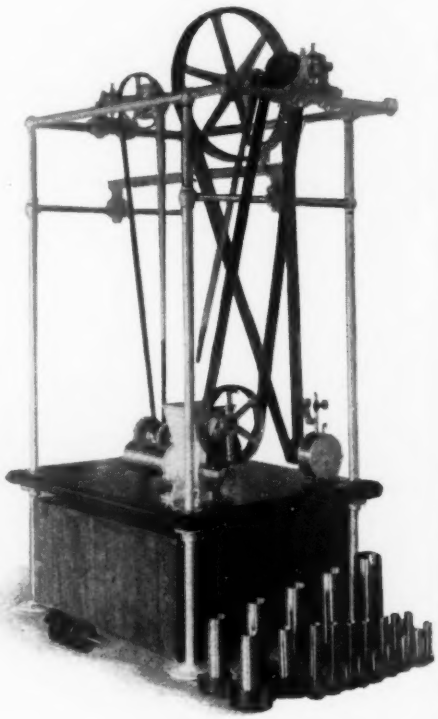
The question has been asked frequently—"What lengths of cores can be made in this machine?" Thus far the efforts for the production of cores have been confined to a length of 24 in., but recently an experiment was made to see how long a core could be run out, and a core 10 ft. 6 in. long and 6 in. in diameter was made without any difficulty, and, if any firm desired to go to the expense of sufficiently stiff supports for receiving the core, there is evidently no reason why cores of considerable length cannot be made without any difficulty.

As most foundries are using hand made cores, it may be of interest to compare these machine made cores with hand made cores. In the first place, practically all hand made cores are rammed with some form of rod, which must of necessity result in very unequal hardness in different parts of the core; hence in unequal venting. The core mixtures necessary for hand ramming have to be worked wetter than those for the machine, which takes longer and considerably more fuel to bake. When the core is rammed in a core box, the sand remains at the point in the box with which it first comes in contact and is simply compressed in that position. The result is that grains of sand on the surface of the core may lie in any position; hence cannot give as smooth a surface as is the case when the sand is forced through a die, which slicks the surface. It is true that some hand made cores are used without blackening, but in most cases blackening is necessary. I believe that with the proper selection of core mixtures, blackening can be dispensed with on practically all small machine made cores, such as can be made with a machine of the type mentioned, and which the writer has the pleasure of demonstrating before you gentlemen this evening.

Fire at the plant of the J. A. Fay & Egan Co., Cincinnati, O., manufacturer of woodworking machinery, Sept. 23, caused a loss of $200,000.

A CORE MACHINE EXHIBIT.

Mr. Geo. H. Wadsworth, of the Falls Rivet & Machine Co., of Cuyahoga Falls, O., took one of his core machines with him to Philadelphia, to illustrate his talk on mechanically made cores. In addition to this, he has one mounted in exactly the same way on exhibition in the Model Foundry at St. Louis, with the exhibits of the Hill & Griffith Co., who are selling agents for the machine. The arrangement is shown in the accompanying illustration, in which the core machine is at the front of the platform and a pneumatic



A CORE MACHINE EXHIBIT.

motor in the rear at the right. The pneumatic motor drives a countershaft, from which both the core machine and the grinding wheels for coning cores are driven. When exhibiting the device at Philadelphia, compressed air was not available, and hence the countershaft was driven by a belt from an electric motor, but at St. Louis the device was belted up as shown in the accompanying illustration. A full set of dies for making all sizes of cores from six inches down is shown in the illustration.

EXHIBITS OF INTEREST AT THE LOUISIANA PURCHASE EXPOSITION, ST. LOUIS, MO.

In addition to the special exhibits mentioned later, there are many points in connection with the various exhibits or buildings which will certainly be of interest to foundrymen. In the Mines & Metallurgy Building there are extensive exhibts of iron ores, coal, coke and pig iron. A number of the iron companies have models or photographs of their mines.

There are also exhibits of copper ores and matter illustrating the various processes which the copper must go through during its manufacture. Many other metals used in making alloys are shown, both in the ore and in the finished metallic product.

One of the most instructive exhibits of this kind is in connection with that of the Bethlehem Steel Co., which is located in a depression of the floor of the building. Along the sides of the exhibit are a series of bins or boxes, containing various grades of iron ore, limestone, coal, coke, and pig iron used in the manufacture of iron. This exhibit also contains a set of the sections of the Pennsylvania tunnel castings, and many other points which would be of interest to any one associated with the metal industries.

ALABAMA'S EXHIBIT.

The Alabama exhibit in the Mines Building is certainly interesting to anyone connected with the iron and steel industries. In the center towers the great cast iron statue of Vulcan. This is 56 ft. in height and weighs 60 tons. The original plaster model for this great statue was made by the New York sculptor Moretti. After his sketch or model was complete he made a full-sized plaster statue, which was subsequently taken down and shipped to Birmingham, where the casting was made. When finally erected in Birmingham in its permanent position, the statue is to stand on a pedestal 10 ft. high and for this reason the head has been made slightly larger than correct proportion would call for, in order that it may not seem out of proportion when erected in its final place.

Surrounding the statue are many exhibits of Alabama products, including iron ore, pig iron, coal, coke, and finished iron in various forms.

STATUE OF VULCAN IN THE MINES AND METALLURGY BUILDING.

EXHIBIT OF INTERNATIONAL NICKEL CO.

In Block 42-B, of the Mines and Metallurgy Building, is located the exhibit of the International Nickel Co., which contains a great deal of material of interest both to foundrymen and all who are interested in metals and metallurgy. At the western end of the exhibit there is a great pyramid of nickel ore from the Creighton Mine, Sudbury District, Canada. This ore is mined and smelted by the Canadian Copper Co., of Copper Cliff, Ont., one of the constituent companies of the International Nickel Co. Tastefully arranged on and around the pyramid is an exhibit of roasted ore and matte. The nickel ore, as it occurs, is a combination of sulphur, copper and nickel, which is roasted to drive off some of the sulphur, and then smelted to a rich sulphide of copper and nickel, which is termed matte. It is from this that the pure copper and nickel are subsequently separated. At

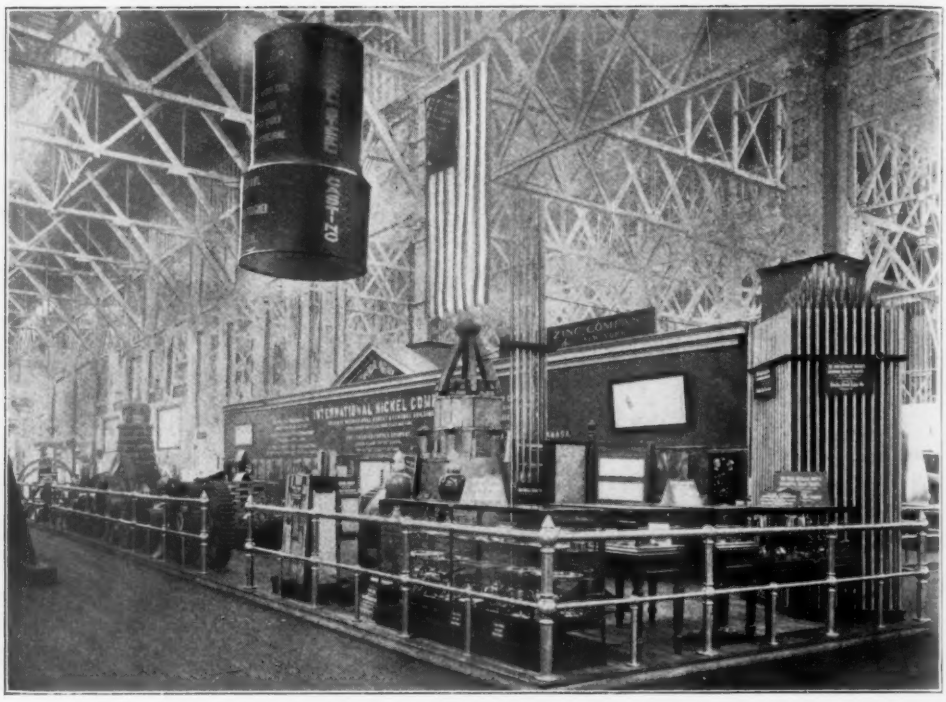


EXHIBIT OF THE INTERNATIONAL NICKEL CO.

the eastern end of the exhibit there is shown a quantity of ore from the Vermilion Mining Co., the Anglo-American Iron Co., Nickel Corporation, Ltd., and the Societe Mining Caledonienne, which are also constituent companies of the International Nickel Co. At this same end of the exhibit there is a pile of nickel blocks, which is the form in which the nickel is furnished for making open hearth and Bessemer nickel steel. This pile of blocks weighs 16,000 pounds. This represents the amount of nickel in the finished turret of the battleship Iowa, which weighs 486,080 pounds, or 217 gross tons.

A portion of the back wall of the exhibit is covered with handsomely polished nickel sheets, the sheets being separated by the copper molding, thus forming a very striking background.

Among the portions of the exhibit which are of less interest to foundrymen may be mentioned nickel cooking utensils, nickel steel boiler tubes, and many similar products. The pure grain nickel is also shown in large glass jars.

The advantages of the physical properties of nickel steel over carbon steel cannot fail to suggest many applications where this special steel is of decided practical advantage and where the conditions of service amply warrant its somewhat increased cost. That prominent manufacturers throughout the country have found nickel steel to be an advantageous material to use is shown by the extensive use of nickel steel castings and forgings, both in England, Europe and this country. A number of nickel steel castings are exhibited, including several nickel steel gear wheels, which show remarkably good examples of the foundrymen's skill.

There are also several nickel steel rolls on exhibition which were cast for use in this country.

Suspended over the center of the exhibit so that it is visible from every part of the building is a full-size model of the largest nickel steel casting ever made. This was a cylinder for a 10,000 ton hydraulic armor plate forging press. It was cast from six percent nickel steel by the Carnegie Steel Co., in 1886. In service this casting (which is still in use) withstands a pressure of 56,000 pounds per square inch. The casting weighs 140 gross tons. There are many other points in connection with the exhibit which will certainly be of great interest to any one who will take the time to visit the display. Among the companies whose material is on exhibit in

1. EXHIBIT OF THE CARBORUNDUM CO., OF NIAGARA FALLS, N. Y. 2. EXHIBIT OF THE NORTON EMERY WHEEL CO., WORCESTER, MASS.; THE PIKE MFG. CO., AND THE CLEVELAND STONE CO.

this space on account of the use of nickel in the material, may be mentioned the Mesta Machine Co., of Pittsburg, Pa.; Cambria Steel Co., Johnstown, Pa.; Standard Steel Works, Burnham, Pa.; Pennsylvania Steel Co., Steelton, Pa.; Central Iron & Steel Co., Harrisburg, Pa.; Carbon Steel Co., Pittsburg, Pa.; Coe Brass Mfg. Co., Torrington, Conn.; Shelby Steel Tube Co., Pittsburg, Pa.; Taylor Iron & Steel Co., High Bridge, N. J.; American Iron & Steel Co., Lebanon, Pa.; and Westmoreland Steel Co., Pittsburg, Pa.

ABRASIVE EXHIBITS AT THE ST. LOUIS EXPOSITION.

All foundrymen are interested in grinding wheels and materials, and as a consequence will find a great deal of interest in the various abrasive exhibits at St. Louis. In the Mines and Metallurgy Building, a number of

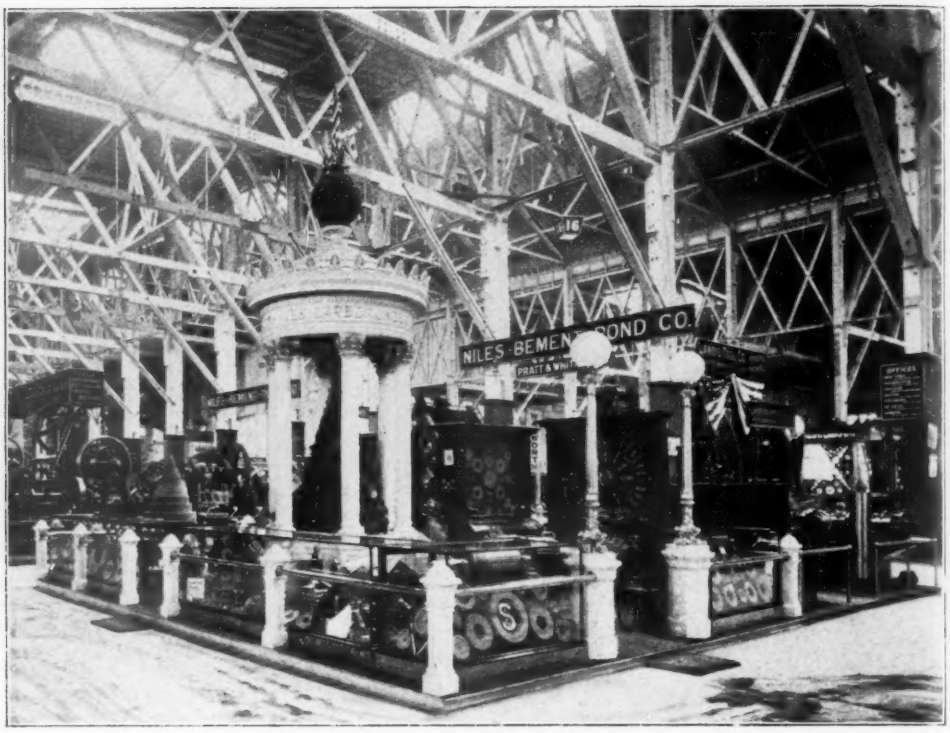


EXHIBIT OF THE CARBORUNDUM CO. IN THE MACHINERY BUILDING.

the mineral exhibits contain displays of corundum and other natural abrasive materials. In the Canadian section there is quite an exhibit of corundum wheels.

On one side of the building there are two adjacent exhibits which are of considerable interest. One is that of the Carborundum Co., in which they exhibit models of their electrical furnace, in which are produced carborundum, carborundum fire sand and many other products. They also have models or relief maps showing the arrangement of their plants at Niagara Falls, and some interesting exhibits of the products of their Niagara Falls plant, though the main portion of the exhibit of finished product is in Machinery Hall, in connection with the exhibit which will be described later. In the adjoining space is located a combination exhibit of the Norton Emery Wheel Co., of Worcester, Mass., the Pike Mfg. Co., and the Cleveland Stone Co. The Norton Emery Wheel Co. manufacture artificial corundum in electric furnaces in their plant at Niagara Falls, and to this product they have given the name "alundum." This product, as it comes from the furnace, is exhibited, together with other materials manufactured or dealt in by this company. The Norton Emery Wheel Co. also manufacture the Indian oil stones, made from Indian corundum, which are sold by the Pike Mfg. Co. The Cleveland Stone Co. has an exhibit of grindstones.

In the Machinery Building about the center of the building there is located a group of very interesting abrasive exhibits. The first one of these is that of the Carborundum Co., and as shown by the accompanying illustration, this is gotten up in very neat style. The pyramid of carborundum surrounded by the white pillars is arranged to rotate, and forms a very attractive feature, as the crystals reflect the light and gleam like gems.

Surrounding this are cases containing many of the different styles of grinding wheels and stones manufactured from carborundum, together with some of the products finished upon these wheels. Carborundum is next to the diamond in hardness, as it is harder than emery or corundum. The history of the discovery of carborundum, and something of its properties, are probably well known to most of the readers of *The Foundry*. It is probable, however, that few know the great

EXHIBIT OF THE NORTON EMERY WHEEL CO. IN THE MACHINERY BUILDING.

variety of material cut by this abrasive. It is used for finishing materials ranging from hard steel and white hard iron to soft rubber, cork and leather for kid gloves. When one considers this range it will give some idea of the number of different qualities of wheels necessary to cut these different classes of material. They have installed a Landis grinder, upon which they give examples or demonstrations of the grinding ability of carborundum.

In an adjoining space is situated the exhibit of the Norton Emery Wheel Co., of Worcester, Mass. This company is not confined to one abrasive for the manufacture of their wheels, but use emery, corundum, and their own abrasive manufactured in the electric furnace and named by them "alundum." The exhibit of the Norton Co. occupies more space than that of the Carborundum Co., and consists in an exhibit of grinding wheels of all types, together with various styles of grinding machines manufactured by the Norton Grinding Co., which is associated with the Norton Emery Wheel Co. Upon each side of the exhibit are arranged a number of pillars composed of emery wheels, each pillar being surmounted by a sphere with an eagle upon it. The base of each pillar is made of tubing ground on the Norton grinding machine.

The artificial abrasive manufactured by this company and known as "alundum," is a new product, which is made in the electric furnace at a temperature of about 6,000 degrees. It is really artificial corundum, and has given marvelous results as a grinding material, especially for foundry use. It is also made in the form of alundum paper and cloth for polishing. This material is shown in the exhibit in the raw state, as well as in the form of paper, cloth and grain. The floor grinders or grinding stands are well proportioned, heavy machines, with ring-oiling, dust proof bearings. They will be of special interest to foundrymen; while the universal tool and cutter grinders shown and the large Norton grinding machine do not come within the sphere of the ordinary foundry work they will nevertheless be of interest to many foundrymen. The largest one of these machines in the exhibit will take work 18 inches in diameter by 10 feet in length and yet is a remarkably compact, self-contained machine, and extremely easy of operation and control.

The largest wheel in the exhibit is about 5 feet in diameter, 6 inches thick and weighs

AN INSTRUCTIVE MALLEABLE IRON EXHIBIT.

nearly a ton. When this is compared with some of the tiny dental wheels exhibited, an idea of the range of the wheels made by this company can be obtained. A large exhibit of ground work is shown, together with complete data as to the time consumed in grinding the various pieces and the accuracy of the work.

Opposite the Norton exhibit is the exhibit of the Sterling Emery Wheel Co. As the

EXHIBIT OF THE STERLING EMERY WHEEL CO.

man in charge of the exhibit stated, "They have wheels from those with grit so rank that they fairly gnaw a raw casting as a wolf does a bone, to tiny juniors which take a cut that is hardly perceptible," and lying between these two extremes are many different classes to be seen. The Sterling emery wheels are all made by the vitrified process, in which the material which holds the grains together, that is the bond, is said to be of such a nature as to assist in the cutting. They are open and porous and when properly graded will not fill up or glaze. They will run equally well wet or dry. The company also manufactures a full line of bench and floor grinders, which have been carefully designed to give the proper distribution of metal to insure the desired strength and weight. The porous character of their wheels is shown by placing one of them in a horizontal position and having water flowing through it. Some of their wheels are arranged with a metal webbing in the wheel to guard against breaking or bursting of the wheel.

Opposite the corundum exhibit is that of the Cortland Emery Wheel Co., in which they have an exhibit of corundum wheels made from pure Craig mine corundum. They also have an exhibit or corundum in bulk.

In connection with the Goldschmidt Thermit Co.'s exhibit in the Metals Pavilion, there is also something of an exhibit of abrasive materials made from the slag from the thermit process, but this will be described in connection with their exhibit.

INSTRUCTIVE MALLEABLE IRON EXHIBIT.

In the Mines and Metallurgy Building, near the Alabama exhibit, is situated the exhibit of Arthur E. Barlow, of Newark, N. J., malle-

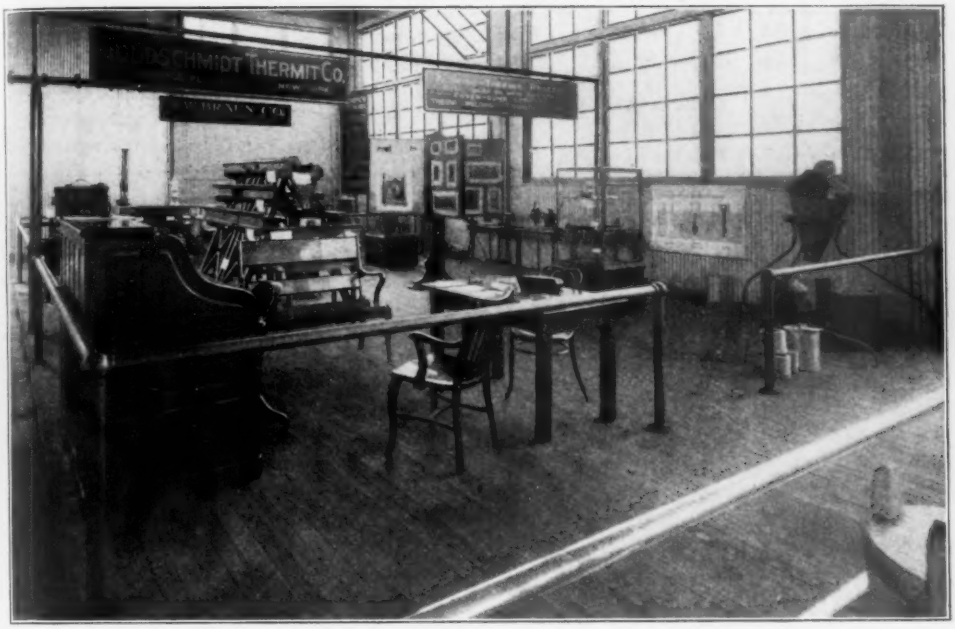


EXHIBIT OF THE GOLDSCHMIDT THERMIT CO.

able and gray iron founder. This exhibit is interesting to foundrymen mainly on account of the fact that the process of making malleable castings is very well illustrated. In the center, at the rear, there is a molding machine fitted with patterns for making molds for malleable castings. Just forward of the molding machine there is a table showing an exhibit of malleable castings. At the right in the rear is a model of a melting furnace used for melting the iron for malleable castings, while at the left in the rear, there is a model of the annealing furnace with the annealing pots in place.

EXHIBIT OF THE GOLDSCHMIDT THERMIT COMPANY.

The Metals Pavilion also contains the exhibit of the Goldschmidt Thermit Co. In this they have a large number of very interesting features. There are molds of various forms into which the molten thermit can be poured, crucibles in which the thermit ignition takes place, and a large crucible which has been divided longitudinally so as to show the manner of lining, closing the bottom, and filling with aluminum thermit. They also have exhibits of molds and devices used for welding pipe by means of aluminum thermit, an exhibit of rails bonded by the aluminum thermit process and of castings mended by this process. One of the interesting castings shown is that of a gear, one tooth of which had been broken out and a new one burned in by means of aluminum thermit. The exhibit also contains pieces of rare metals reduced by the electric furnace, such as manganese, chromium, etc., which are rarely seen in their pure state. They also have an exhibit of abrasive material made from the slag resulting during the welding process. This slag is crushed and used for making grinding wheels or used in the crushed form the same as emery or corundum. In addition to the exhibit in the Metals Pavilion, the Goldschmidt Thermit Co. give a daily exhibition of welding by their processes at some point upon the grounds, usually in front of the Metals Pavilion.

The business people of Clinton, Tenn., have been planning to organize a foundry for some time. The work is now in the hands of a committee composed of C. W. Cross, A. E. Radart and J. R. Evans. C. L. Sawyer will be president; A. Taylor, vice president; C. H. Johnson, general manager.

The Retail Merchants' Association, of Nashville, Tenn., has sent a committee to Chicago to appear before the board of directors of the American Skein & Foundry Co. to endeavor to induce them to establish a plant at Nashville.

THE FOUNDRY.

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TRADE OUTLOOK.

The foundry situation has improved in the past month and the quantity of iron melted by foundrymen is increasing. Consumption of pig iron has been equal to or slightly in excess of production for the past six weeks. Foundrymen do not report any noteworthy new contracts, but in all lines there is a quickening from the pace of the summer months. Statistics indicate that the pig iron output of the country on October 1 was at the rate of 16,500,000 tons per year. This was considerably less than the rate of production during March, April and May, when the high tide of business carried it up to the rate of 18,000,000 tons. The production of pig iron is now on its second upturn for the year, and the extent of this movement will depend on a number of factors. One of these factors is the uncertainty caused by the coal strike in the South. Should it end, a considerable increase in the output of the southern furnaces would be made toward the end of the year.

In the North there are a good many idle furnaces, and if the price were to advance sufficiently, it is certain that some of these would be blown in. The merchant stocks of pig iron were reduced 75,000 tons during September, despite the fact that production of coke and anthracite iron had increased 185,000 tons over that of August.

This increase, however, must not be taken to indicate a boom, on account of the fact that production is now considerably below capacity, and the majority of foundries are still far from operating at full capacity. Some of the southern producers have marked the price of their pig iron up to $10.50 at the furnace for No. 2 foundry and others to $11 per ton, but this has very little effect on the market, on account of the fact that most of the furnaces which have done this have no pig iron to sell at the present. Northern foundry irons, however, have advanced recently and the minimum for No. 2 foundry is now $12.25 per ton at Central Western furnaces, and some sales have been made at $12.50 Bessemer iron has sold at $12.50 at the furnace and $12.75 is now asked.

The coke market has been temporarily affected by a shortage of water supply in the Connellsville region, which has caused the putting out of nearly a thousand ovens. It is interesting to note, however, that factors of this kind do not have as great an effect on the foundry trade as they did some years ago, since by-product coke is being used more extensively each year for foundry practice.

Just as we are going to press we receive the following information: The foundry iron market is much stronger with prices fifty cents higher in the week. The Corrigan furnaces have put up prices to $13.50 at furnace. There is general buying by foundries, one Buffalo foundry taking 4,000 tons. Consumers are evidently buying to protect themselves against advance.

FOREIGNERS VISITING THE UNITED STATES.

Every year sees a large number of foreigners, especially from England and Germany, visiting the United States and studying our manufacturing methods. This year has brought an extra large number of such visitors. Many have come to see the Exposition at St. Louis and at the same time visit American plants. Others have come with those attending the various national or international engineering meetings. The meeting of the Iron and Steel Institute has brought a large number of such visitors. The question of entertaining such visitors and showing them through our plants is one that has confronted many manufacturers.

We believe that one of the greatest secrets of American industrial supremacy has been that the American manufacturer has had but few trade secrets, and has always been glad to share, even with his competitor, any new ideas of the arrangement of plants, machinery, etc., relying upon quality, organization and management to maintain his position in the market. This interchange of ideas and experience has enabled each man to go ahead very much more rapidly than he could otherwise. In the same way, one who entertains our foreign friends runs no risk of injuring himself by building up a rival, and the friend-

ship so gained and the information obtained frequently much more than compensate for all the trouble.

We regret that some American works are so close in regard to the matter of admitting visitors to their plants, but are glad to note that most of our manufacturers are always ready to welcome any one who is interested in their line of manufacture. Incidentally, there is one point which has resulted in the visits of foreigners to our foundries, and that is, that many American devices have been installed in foreign foundries. A German foundryman who visited the United States recently stated that he believed that certain makes of American molding machines were better known in Germany than any German machinery for similar purposes. The courting of publicity rather than a policy of secrecy and exclusion will doubtless result in similar testimony concerning other American products.

NEW BOOKS.

"Mechanical Drawing," by Limus Faunce, published by Hinds, Noble & Eldredge, New York, N. Y., price $1.25. This work has already gone through twelve editions and hence the author has had ample opportunities for corrections and changes. It was formerly published by the author, but the copyright has now been secured by the present publishers. The author prepared the work for the use of the students at the Massachusetts Institute of Technology, and hence the work was written with the idea of supplementing it by class room or lecture work. It contains 146 pages and nine plates, together with numerous other illustrations. The book is certainly excellent as a book of instruction for any drawing class, and also any one who has an elementary knowledge of the subject or is familiar with drawings to some extent, could take the book and gain a great deal of useful information from it.

"Foundry Practice," by James M. Tate and Melvin O. Stone, published by the H. H. Wilson Co., Minneapolis, Minn. Price $1.50. The work is 6 x 8 inches and contains 233 pages. This work was written especially for the use of college students and is intended to give a fair knowledge of foundry practice, for use in connection with the shop work required in most of our technical schools. In many points the work evidently presupposes the presence of an instructor, on account of the fact that some points are not gone into very fully. The authors, however, begin with the molding sand, and tell a connected story of foundry practice, touching upon all of the principal points, including the different methods of molding, the setting of chaplets, etc. Some illustrations of machine molding, cores and core work, sweep work, cupola and furnace work are given. A glossary of foundry terms is given and also some useful tables concerning iron mixtures, alloys, etc. This work will be found of use not only to college professors and college students, but also to young men who are just entering foundry work, or to any one who wishes elementary knowledge of foundry practice.

"Business Short Cuts," published by the Bookkeeper Publishing Co., Ltd., Detroit, Mich. This is a compact little work, 5¼ x 7½ inches, containing 152 pages of closely printed matter, price $1.00. It is especially suited for accountants, bookkeepers, etc., and contains many useful hints as to methods of detecting errors in accounts, short cuts in business, handy methods of keeping records, and in fact, a great deal of extremely useful information which it is well for a busy man to know. As stated, however, this book is of greater interest to accountants, bookkeepers, etc., than to the average business man.

"Manufacturing Costs," by H. L. Hall, published by the Bookkeeper Publishing Co., Detroit, Mich, price $2.00. This is a neat little work 5 x 7½ inches, containing 191 pages, but despite the small size of the book it will be found to contain a large amount of valuable information. The margins have not been made extra wide, so that without crowding of printed matter they are able to get in a very large amount of information of interest to cost keepers, works managers, and business men in general. Most articles on cost keeping have set out or described systems in use in certain specific cases. This book differs from such works in that it gives a description of what cost keeping is, how it should be carried on, and how one should go about laying out or planning of a cost-keeping system for any class of work. Many useful cards and forms are shown and a description given of various time-saving devices used in connection with cost-keeping. The work will certainly be found of great interest to all who have cost-keeping problems to solve or who are interested in manufacturing costs. Many manufacturers make the serious mistake of not looking into cost-keeping methods and finding how such methods may serve them in their business.

SCRAP IRON SPECIFICATIONS.*

BY W. G. SCOTT, RACINE, WIS.

"Scrap Iron" is the name usually given to the miscellaneous collection of broken and worn out castings used along with pig iron in making foundry mixtures.

Strictly speaking, the term applies more appropriately to the conglomeration of iron known as "foreign scrap" or that which is obtained from the junk dealer, who makes a business of collecting such material.

Home scrap consisting of gates, sprues, risers, defective castings, and "shot iron" is more properly termed "the remelt," and at the present time where most foundry mixtures are made by analysis, its composition is not considered as an "unknown quantity."

The object of this paper is a general classification of the material known as "foreign scrap" which at the present time, in many cases, is purchased by specification.

Under the head of foreign scrap may be included the following kinds of material, viz.: Gray iron, chilled irons, malleable iron, cast borings, steel, wrought iron, and steel or wrought iron borings.

The common gray-iron cupola founder will prefer a good grade of gray iron scrap; the malleable iron founder may wish to include steel scrap; the Mitis metal maker will want wrought iron, and the cast-steel producer may require something else, therefore the necessity of a general classification.

The writer has been requested by several large manufacturing concerns to classify the material in such way that it may be controlled by specification if desired, but as a rule such classification can only be brought about by the purchaser insisting upon the agent or junk dealer sorting the scrap, or in case it is not sorted, to claim a rebate before paying for the material.

It is proposed to classify foreign scrap as follows:

(1) Light machinery scrap (gray-iron).
(2) Heavy machinery scrap (gray-iron).
(3) Stove plate scrap (gray-iron).
(4) Car wheel and chilled iron (gray-iron).
(5) Cast borings.
(6) Malleable iron scrap.
(7) Steel scrap.
(8) Wrought scrap.
(9) Mixed scrap.

It is impossible to establish a cast iron rule, or to formulate a rigid specification in regard to the classification of scrap, as such a course would have a tendency to raise the price of the better grades and force the culled material upon the small foundries.

It is proposed to briefly describe the kind of material suitable for each particular class, explain its proper use, and give a general average analysis of the iron or steel.

(1) Light Machinery Scrap.

This class of scrap will usually consist of the broken parts of agricultural implements, sewing machines, ornamental iron work, cast fixtures, etc.

Most of the material will be less than two inches in thickness, except certain portions like the hub of a wheel, or perhaps a large support; as a rule, however, the iron will be thin and consequently should be soft.

The average analysis of light scrap will generally be found to be within the following limits:

Silicon	2.00	to 2.60	percent
Sulphur	.075	to .095	percent
Phosphorus	.70	to .90	percent
Manganese	.20	to .60	percent
Total Carbon	3.00	to 4.25	percent

Light machinery scrap is considered superior to all other grades for general gray-iron work. It increases the strength of soft iron mixtures and produces but little slag, unless much rust be present, in which case it has a tendency to harden the iron somewhat and increase the "melting loss," the rust uniting with the slag to form silicate of iron which is an undesirable element in good cupola practice.

The proper amount of scrap to be used in melting will, of course, depend upon the quality of castings desired.

The usual amount is from 30 to 50 percent, but with a medium low sulphur and the desired silicon there is no objection to an unlimited increase.

Some foundrymen use all scrap with a little ferro-silicon softener and a small amount of ferro-manganese, but such mixtures are uncertain and cannot be controlled by analysis or otherwise.

Increase in scrap means decrease in total carbon, hence the iron becomes harder, stronger and more close grained.

Light machinery scrap, if sorted, costs almost as much as pig iron, therefore in most cases the buyer makes no distinction between light and heavy machinery scrap, merely specifying that no large pieces shall be included.

The following specifications cover this point:

Specifications for Machinery Scrap.

Under this specification is desired a good,

* Paper read at the A. F. A. Convention, June, 1904.

clean scrap iron, such as agricultural implement and light machinery scrap.

The scrap must contain no wrought iron, steel, stove plate, grate bars, car wheels, brake shoes, chilled roll, etc.

Malleable scrap is objectionable, also an excess of rusty iron.

Large pieces weighing more than 400 lbs. will not be accepted.

When a car of scrap is received the inspector will superintend the unloading and discard the following objectionable material, viz.: Wrought iron pieces, steel, burnt stove plate, grate bars, car wheels, brake shoes, large chilled work, burnt malleables, and large pieces weighing more than 400 lbs.

Rejected scrap will be deducted from the total weight of scrap received, and payment made only on accepted material.

(2) Heavy Machinery Scrap.

As the name implies, this scrap will consist of large pieces from fly-wheels, engine beds, large pumps, blowing machinery, mining machinery, gears, cast die blocks, mill castings, architectural castings, etc.

The pieces may weigh several tons or may be broken into small pieces, in any event the pieces will naturally be large and heavy, consequently will be too large for the ordinary cupola.

The breaking of heavy castings is a serious problem and not only involves an extra amount of work, but adds to the expense.

The average analysis will usually be found within the following limits:

Silicon	1.60	to 2.20	percent
Sulphur	.075	to .150	percent
Phosphorus	.40	to .80	percent
Manganese	.30	to .90	percent
Total carbon	2.75	to 4.00	percent

Heavy scrap is generally used for heavy work, and should be melted in a large cupola.

The amount varies from 20. to 60. percent, but should not exceed 50. percent if the iron is mixed by analysis and the castings are to be made by specification.

Where the resultant castings are not made under specification any amount may be used, provided enough silicon be present to insure a fairly soft iron for machining.

Specifications for heavy scrap are worded as follows, viz.:

Specifications for Heavy Cast Scrap.

Material purchased under this specification is understood to belong to the class of cast iron known as "heavy scrap," consisting of bed plates, gears, wheels, supports, engine parts, cast pipe, heavy machinery, etc.

The following material is objectionable and will not be accepted, viz.: Burnt annealing pots, burnt furnace castings, wrought iron or steel shafts, steel plate, sheet iron, galvanized iron, etc.

Such material will be thrown aside and payment made only on the accepted scrap.

(3) Stove Plate Scrap.

New stove plate is considered as an excellent soft scrap on account of the high silicon, graphite and phosphorus content.

Old stove plate containing burnt iron and an unlimited amount of rust, is objectionable, and many foundrymen will not use it at all. Old stoves and furnace castings which have been in use for years are generally pretty well "burnt" and consequently are high in sulphur and low in graphite.

New stove plate is scarce and high in price, while old stove plate is cheap; therefore very little of the former article is found in the scrap now on the market.

No specification calling for *new* stove plate scrap would be effective, as it is almost impossible to get such a grade.

The only specification that we know of makes no such distinction, but deals with the ordinary mixed scrap in the following manner:

Specifications for Stove Plate Scrap.

The scrap purchased under this specification is assumed to be a soft cast iron consisting mostly of *broken* parts of stoves and furnace castings.

An admixture of light machinery scrap is permissible, but parts of stoves from the fire box are objectionable, also pieces which are badly warped or burnt.

On receipt of a shipment or load of stove plate scrap the material will be sorted and the "objectionable" material laid aside.

The purchaser retains the right to reject such material, or to accept it at a reduced price, providing it may be made into grate bars, sash weight, etc.

It is distinctly understood that this latter clause be optional with the purchasing agent.

It will be seen from the above specification that there is a serious objection to burnt iron, yet there is a desire to keep such poor material providing the price is right, and we are inclined to think that all of the burnt iron is not made into sash weight.

Taking the average run of stove plate scrap,

including a small amount of fire box parts and other objectionable pieces, the material will generally analyze within the following limits:

Silicon	2.30	to 3.30	percent
Sulphur	.075	to .135	percent
Phosphorus	.45	to 1.25	percent
Manganese	.20	to .70	percent
Total Carbon	3.50	to 4.50	percent

There is a wide variation in the above, but it must be remembered that there is a vast difference in the composition of new and old stove plate scrap, furthermore that one founder believes in high phosphorus and silicon, whereas another might think the desired fluidity could be obtained with a high carbon and silicon; both, however, adhere to the high silicon idea.

High phosphoric iron is easily fusible, while high graphite iron is the reverse, consequently the latter mixture is now favored.

The following analysis of new stove plate and the same material after two years' usage illustrates the difference in composition:

	New Material	Old Material.
Silicon	2.60	2.52 percent
Sulphur	.089	.117 percent
Phosphorus	.720	.731 percent
Manganese	.30	.21 percent
Combined Carbon	.20	.42 percent
Graphitic Carbon.	4.00	3.56 percent

The piece in question was said to be part of the fire box and the claim is made that the great increase in sulphur was due to the absorption of sulphur from the coal, evidently it must have been a poor grade of soft coal.

(4) Car Wheel and Chilled Iron Scrap.

Car wheel scrap is a very desirable material for strong and hard cast iron mixtures.

The only objection to this class of scrap for use in the ordinary foundry is in the size of the pieces and the labor required to break the wheels into sufficiently small pieces.

A 1,000-lb. weight dropping 10 ft. is hardly sufficient to reduce the large wheels to proper size, consequently repeated blows are required and much time consumed.

A larger weight or higher drop is more effective, but very few foundries are supplied with the proper apparatus.

For large work and with a large cupola the trouble is not so great.

"Car wheel scrap" is considered a superior grade of cast iron on account of the low phosphorus content and consequent strength.

The following specification gives a good idea as to the quality of cast iron which may be included in this class:

Specifications for Car Wheel and Hard Iron Scrap.

The following material will be accepted under this specification, viz.: Cast iron car wheels; chilled iron rolls, gears, grinders, etc., semi-steel castings; cast iron gun metal; steam cylinders etc.

Brake shoes, malleable iron car scrap, journal boxes, etc., are not desired.

Steel castings and die blocks are also objectionable unless especially specified.

All undesirable material will be sorted out, and may be rejected, or retained if found to be in accordance with our specifications for such other class of scrap.

The sorting of material will be superintended by the inspector and payment made in accordance with the class of scrap received.

Specifications for scrap iron are liable to be drawn too rigid, but the desire to obtain a class of scrap suitable for certain specified purposes is an excuse which must not be overlooked.

Car wheel and hard iron scrap although very desirable for certain classes of work, must be used with caution in ordinary foundry mixtures, as the low phosphorus and silicon have a tendency toward sluggish iron or lack of fluidity.

There is quite a variation in the chemical composition of car wheels, chilled rolls, semi-steel, etc., belonging to this class of scrap, but the following limits will be a close approximation:

Silicon	.50	to 1.75	percent
Sulphur	.075	to .150	percent
Phosphorus	.30	to .65	percent
Manganese	.30	to .90	percent
Total Carbon	2.00	to 3.75	percent

If semi-steel were not included in this class the average analysis would correspond closely with that of a good cast iron car wheel mixture.

(5) Cast Iron Borings.

Cast borings can hardly be considered as a legitimate scrap iron, and as a rule are not desired by the foundryman.

On account of the fineness of the particles much of the iron is lost in melting either by being burned up or oxidized, or uniting with the slag.

In some cases the loss exceeds 30 percent, and under the most favorable conditions is seldom less than 10 percent.

Numerous methods have been tried in melting borings, one of which is to enclose them in strong pine boxes and charge in the cupola along with the pig iron.

Another method is to enclose them in sheet iron boxes, but this is somewhat expensive and not very satisfactory.

Borings made into briquettes with pitch are not a success, as the binder melts too easily. Briquetted with lime, salt, cement, etc., this defect is overcome, but other objectionable features are presented, in which the excess of rust, due to the water introduced, is a serious objection.

The amount of metallic iron in a good cement bound briquette seldom exceeds 80 percent; if, however, we include the graphite, manganese, etc., the total considered as pig iron would not exceed 88 percent, thus leaving at least 12 percent of residue which goes into the slag.

The amount of binder or cement is usually about 5 percent, while the remaining 7 percent consists of iron oxide, water, dust, etc.

Briquettes have been made with more iron than above stated, but actual experience has proven that the regular run of such material is similar to the above figures.

Good results are obtained by melting 10 to 20 percent of briquetted boring with regular scrap and pig iron.

Briquettes melted alone produce an excess of slag and bung up a cupola so that it is impossible to draw off the iron.

The ideal method of melting borings is by means of an air furnace or the open-hearth furnace, in which event the iron takes up very little sulphur, although there is quite a loss from oxidation.

Borings melted in a cupola (using the material packed in wooden boxes) is as good a method as any yet devised in general foundry practice, but there is considerable loss or waste and a large increase in the sulphur content.

Borings showing on analysis .085 percent of sulphur, melted with foundry coke (containing 80 percent of sulphur), will produce an iron containing about .120 percent of sulphur.

Borings mixed with tap cinder and ore produces an interior quality of pig iron, and fortunately there is very little of it on the market.

The only specification we know of for this class of material reads as follows:

Specifications for Cast Iron, Steel and Wrought Iron Borings.

In making contracts for borings it is stipulated that the manufacturer, machine shop, or iron mill superintendent, see to it that the different kind of borings, punchings, etc., be stored in proper bins and covered in such manner as to exclude rain and snow.

Separate bins must be provided for cast iron borings; steel borings, punching, etc.; and for wrought iron borings.

In case the borings are mixed a reduction in price previously agreed upon will be made.

Borings freed from oil by means of a centrifugal machine or similar device will be paid for at the price affixed in the contract.

In the above specification the last clause relating to oil seems rather superfluous, as most manufacturers consider the oil more valuable than the borings and endeavor to save it.

The average analysis of the three different kinds of borings may be appoximated quite closely, but the variation is necessarily great.

Variable analysis of cast iron borings:

Silicon	1.50	to	3.00	percent
Sulphur	.075	to	.165	percent
Phosphorus	.30	to	1.25	percent
Manganese	.20	to	.90	percent
Total Carbon	2.50	to	4.50	percent

Variable analysis of steel borings:

Silicon	.00	to	.50	percent
Sulphur	.015	to	.095	percent
Phosphorus	.015	to	.18	percent
Manganese	.10	to	1.00	percent
Combined Carbon	.10	to	1.50	percent

Variable analysis of wrought iron borings:

Silicon	.00	to	.15	percent
Sulphur	.008	to	.045	percent
Phosphorus	.011	to	.35	percent
Manganese	.00	to	.15	percent
Carbon	.00	to	.10	percent

(6) Malleable Iron Scrap.

There is very little call for malleable iron scrap among the gray-iron founders and the malleable iron men are somewhat adverse to using anything except that which they are familiar with, especially in the annealed form.

White iron is not to be had, as the malleable iron founder can use all the sprue he can make, providing it is of good quality, otherwise some of it may occasionally be found on the market.

Saddlery hardware is generally a pretty good class of scrap, but it is so small in size that there is never a great accumulation.

Burnt annealing pots, over-annealed iron, burnt sprue, etc., is an objectionable class of material, but it is frequently used for sash weights, grate bars, etc.

The loss in melting burnt iron, scale, and rust, is, however, so great, and the resultant casting so poor, that it is a question if such work pays.

We know of no printed specification for malleable scrap but nearly every class of scrap

from light machinery to car wheel generally contains various amounts of malleable iron castings either large or small, and it is simply impossible to make a fine distinction in the matter.

A reasonable amount of malleable iron in gray iron scrap is seldom objected to.

The malleable iron man claims that there is very little malleable iron on the market, as such material never breaks.

The average limits of a malleable iron analysis will be as follows:

Silicon	.30	to 1.75	percent
Sulphur	.035	to .095	percent
Phosphorus	.011	to .22	percent
Manganese	.15	to .50	percent
Total Carbon	1.85	to 4.25	percent

If the total carbon is low the indications are that steel has been used in the mix or that the material has been long annealed.

Malleable scrap is not liked by the gray iron founder on account of the low phosphorus and low silicon, both of which reduce the fluidity of molten iron.

In gray iron castings it is desirable to use an iron containing not less than .30 percent of phosphorus, and for light castings .70 percent is preferable.

In malleable iron mixtures it must not exceed .22 percent, in fact a low phosphorus is desired.

(7) Steel Scrap.

Steel scrap is coming into use more and more every day and is in great demand

It used to be considered an impossibility to melt steel in the cupola and have it mix with the cast iron, but nowadays it is common practice and many foundries are melting from 10 to 40 percent of steel scrap.

With a little experience in charging, regulating the blast, fuel, etc., perfect mixtures may be obtained.

The object in using steel scrap is to reduce the amount of graphitic carbon (in reality it actually reduces the total carbon to a certain extent), thereby producing a hard, strong, close grained iron.

Steel scrap is seldom used in soft iron mixtures unless there be danger of "kish," in which event 50 lbs. of steel to a ton of iron is sufficient to overcome the difficulty.

With 30 percent of steel, 15 to 20 percent of Home Scrap, and the balance pig iron, estimated so that the resultant castings contain 1.50 to 1.75 percent silicon, sulphur not over .075, manganese about .50 or .60, and phosphorus at .40 to .50 percent, the iron will have a tensile strength of 35,000 to 40,000 lbs. per square inch, and the transverse strength on a one-inch square bar, 12 in. between supports will be between 3,600 and 4,500 lbs.

In charging steel scrap in the cupola it must be borne in mind that no small pieces be used, as such pieces seldom melt, consequently mix with the iron and produce hard spots.

Steel rail cut into 16 to 24-in. lengths are considered the best scrap.

The following specification covers the size and other desired points:

Specifications for Steel Scrap.

Under this specification no distinction will be made between open-hearth or Bessemer steel, the main point considered will be in regard to size and general composition.

It may be optional with the purchasing agent to order steel rail, steel castings, clippings, or mixed steel scrap.

In ordering steel rail it is understood that the pieces are to be cut to a length of not less than 12 in. or longer than 24 in. (16 to 18-in. lengths preferred).

In the event of steel castings being ordered, we reserve the right to reject all small pieces, i. e., less than 6 in. in diameter, and extremely large pieces weighing more than 500 lbs.

When mixed steel scrap is ordered it is distinctly understood that no small pieces will be accepted, the smallest size being limited to 6 in. in length or diameter in flats, sheet punchings, clippings, etc.

No borings or shavings will be accepted.

Mixed steel scrap may include—steel shafting, boiler plate, structural steel, springs, cutlery steel, tool steel, cast steel, rail, machinery steel, etc.

Steel scrap shall be divided into the three following classes, viz.:

(A) Rail steel.
(B) Steel castings.
(C) Mixed steel scrap.

The purchasing agent will order the material according to this code, and the inspector will see that the shipment is sorted according to class. Payment will be made on this basis only.

It will be noticed from the above that the preference is for rail steel.

In regard to the other two grades, i. e., steel castings and mixed steel scrap, there is a difference of opinion as to which is the best, some prefer the cast steel while others like the mixed scrap.

The following analysis gives a good idea as to the composition:

Limit analysis of rail steel:

Silicon	.04	to	.50	percent
Sulphur	.025	to	.125	percent
Phosphorus	.04	to	.14	percent
Manganese	.18	to	1.50	percent
Combined carbon	.20	to	.80	percent

Limit analysis of steel castings:

Silicon	.02	to	.50	percent
Sulphur	.012	to	.065	percent
Phosphorus	.02	to	.12	percent
Manganese	.20	to	.80	percent
Carbon	.15	to	.90	percent

Limit analysis of mixed steel scrap:

Silicon	.00	to	.75	percent
Sulphur	.005	to	.125	percent
Phosphorus	.005	to	.25	percent
Manganese	.10	to	1.50	percent
Carbon	.10	to	1.50	percent

The great variation in mixed scrap may be accounted for from the fact that this class of material will contain a mild steel with .10 percent of carbon or a die block of tool steel with 1.50 percent of carbon.

Tungsten, chromium, molybdenum, etc., used in self-hardening steels, is not considered in the above analysis, as the percentage of tool steel in scrap is extremely small.

The rapid cutting tool steels which are usually hardened in a blast of air, belong to this class and contain from 1. to 20. percent of tungsten, with from .25 to 4.50 percent of chromium.

Unless the tool steel is burnt or otherwise damaged, it would be folly to consign such material in the scrap heap.

An unfinished die found in the scrap heap was analyzed out of curiosity and found to be a superior grade of "high speed" tool steel.

The tool maker evidently did not know how to work the metal and probably condemned it as being no good.

The analysis was as follows:

Silicon	.22	percent
Sulphur	.011	percent
Phosphorus	.011	percent
Manganese	.12	percent
Carbon	.52	percent
Tungsten	18.00	percent
Chromium	3.30	percent

In the analysis of the different kinds of scrap the aim has been to include the variation of extremes, consequently for practical purposes it is customary to add the two extremes and divide by 2 for an average, thus: The variation in sulphur being .025 to .125, the average would be .075 percent, which is close enough for estimating the first mixtures when starting out with a change of scrap.

(8) Wrought Iron Scrap.

There is very little call for this class of scrap. It is used in a limited way in the manufacture of Mitis metal, which once was in demand, but has since been forced aside by the modern steel castings.

The high melting point of wrought iron excludes its use in the cupola, although some foundrymen still use a small amount (20 lbs. wrought iron to 2,000 lbs. of pig), to prevent "kish."

Steel scrap answers just as well and is more easily melted.

The following specification defines the use of wrought iron in the manufacture of re-rolled or commercial refined iron:

Specifications for Wrought Iron Scrap.

The following material will be accepted, viz.: Wrought iron rods, shafts, girders, beams, heavy hoop iron, horse shoes, heavy iron wire, spikes, wrought nails, rivets, bolts, flat wrought bars, and other wrought iron material excepting borings, tacks, nuts, washers, etc.

Steel is not desired, but the material will not be rejected on account of a small amount of steel welded or fastened to the wrought pieces.

Rounds, flats, horse shoes, large rivets, heavy wire, etc., are preferred.

Scrap containing washers in quantity or other small pieces will be accepted only at a reduced price.

General analysis of wrought scrap:

Silicon	.00	to	.15	percent
Sulphur	.008	to	.015	percent
Phosphorus	.011	to	.35	percent
Manganese	.00	to	.10	percent
Carbon	.00	to	.10	percent
Graphite	.00	to	.05	percent
Slag	.01	to	1.20	percent

An ideal wrought iron should be low in everything but pure metallic iron.

With manganese or carbon above .10 percent, it inclines to become steely; sulphur makes it red short, and most specifications limit this element to .04 percent.

Phosphorus should be below .10 percent, carbon the lower the better, graphite is objectionable, and an excess of slag shows that the iron has not been sufficiently worked.

The re-rolled or commercial refined iron made from scrap always contains more or less steel, consequently such iron is higher in manganese, carbon and sulphur than the regular puddled wrought iron.

This material generally has a high tensile strength, but the fiber is poor; it is therefore unsuitable for stay bolts, rivets, etc.

(9) Mixed Scrap.

This class of scrap may contain "any old thing," from tin cans to anvils or cannon.

Such material is usually collected by junk

dealers and sorted into the following material: Cast iron, wrought iron, sheet iron, brass and bronze, tinware, lead and similar metals; also steel, providing the junk dealer is able to distinguish it from iron.

The tin is reclaimed from the cans and the remaining iron used for making copperas, melting into sash weights, etc.

The lead and brass go to the bearing metal or Babbitt maker, while the iron is generally sold to the foundry.

Much of this iron scrap is good, but as a rule it is poorly sorted and consequently contains considerable wrought iron.

General Remarks on Scrap Iron.

At present no fine distinction is made in regard to the classification of scrap by the jobbing foundry, but the large manufacturers are more particular and insist on some form of sorting.

Evidently the tendency is along this line and will eventually result in the scrap being carefully sorted by the scrap dealer, resulting, of course, in a scale of prices according to grade.

Every foundryman is inclined to use scrap, preferring it to grey-forge at the same price.

As a rule a mixture containing scrap produces a stronger cast iron than an all pig mix.

There are several reasons for this, one of which is that the graphitic carbon is in a finer state of division than in pig iron.

Another idea is that the total carbon is reduced by addition of scrap, which acts like steel in this respect.

Steel being free from silicon and graphite, not only reduces the silicon and total carbon in a cupola mixture, but actually favors combined carbon.

If a mixture be made from pig iron only, with, say a silicon content of 1.80 percent, all other metalloids being normal; and another mixture be made of pig with, say 15 percent of steel, the resultant cast iron containing 1.80 percent of silicon and identically the same amount of total carbon, etc., it will be found that the steel mixture will be the stronger, and if heat conditions could be absolutely controlled the combined carbon would be higher.

This experiment has been tried several times and even with the same carbon ratio the steel mix was the stronger iron.

This state of affairs may possibly be solved by means of the microscope, hence the "fineness of division" theory will then be made clear.

The claim is also made that the difference in strength and closeness of grain in castings made from charcoal and coke pig iron is due to the finely divided form of the graphite in the former pig iron.

No matter what the cause, or what theory be accepted, the fact remains that an iron containing scrap will be stronger than an all pig mix.

The whole secret of strength in cast iron is conceded to be due to carbon, and is dependent upon the ratio of the two forms, i. e., combined and graphitic.

Furthermore this ratio is greatly influenced by the amount of total carbon within certain limits, for example: A sample of cast iron containing 3.50 percent of graphite or graphitic carbon and .50 percent of combined will not have a strength equal to one containing 2.80 percent of graphite and .40 percent of combined carbon, although each one bears the ratio of 1 to 7.

This is easy of solution, for the reason that graphite has no strength of its own and any excess present simply reduces an equivalent percentage of metallic iron.

In the case cited there was a difference of .70 percent; taking 34,750 pounds as the actual tensile strength per square inch of pure metallic iron, .70 percent of graphite would make a difference of about 243 pounds.

When, however, we go to extremes and reduce the total carbon to a minimum the result is a hard brittle iron; on the other hand, an excess of carbon, especially graphitic, produces a soft weak iron.

Repeated melting will reduce both the silicon and the carbon and eventually result in a white iron.

Scrap iron having been melted one or more times is therefore started on this course and would eventually reach the white iron stage if remelted a sufficient number of times.

The regular foundry re-melt, known as "Home Scrap," is preferable to a "Foreign Scrap," as its composition is known and the remelting has not been carried too far.

Good castings with a high strength may be made from an all scrap mix, providing a little ferro-manganese be added as a cleanser and sufficient ferro-silicon charged to make the iron soft enough to machine.

Making an all scrap mix by analysis is a difficult proposition, but it is being done every day and the results are said to be satisfactory.

In conclusion we pray that the "scrap heap" may be more respected in the future, its value be recognized, and the good separated from the bad.

ECONOMY IN FOUNDRY COST-FINDING.*

BY JAS. C. LOUGHRY.

When we speak of economy in cost-finding, we do not mean only that which implies the least expenditure. Webster, in defining economy, says: "That management which expends money to advantage and incurs no waste; frugality in the necessary expenditure of money. It differs from parsimony which implies an improper saving of expense." To produce without finding the cost, is "improper saving of expense" and not economy. To find the cost of casting requires expense; to educate our children is also an expense, but who in this age looks upon it as unnecessary. Perhaps some children may not yield a profit on such expenditures, but that is the fault of the child or the instructor, and not the education. It may be that for some foundrymen cost-finding has not been a profitable investment, but that is the fault of the system or the one who executes it, and not the knowledge of the cost of their castings.

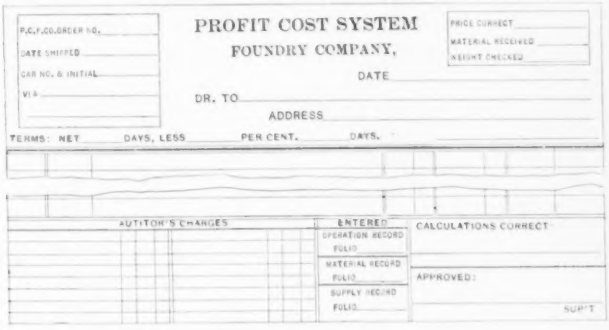
Economy to Know the Cost.

We will not confine this article to the subject of economical methods of determining the cost of production, but to show that it is economy to find definitely the cost of production, regardless of the expense involved, and endeavor to prove it to be, "that management which expends money to advantage." We are inclined to think that some foundrymen consider the value of a cost system, as did the writer of the following letter, the endowment of college chairs (if you will pardon the comparison).

"Lone Tree, April 10, 1903.

"President: Can you preach at Lone Tree church the last Sunday in April, and then go home with me to dinner? Mother and me wants to endow two chairs in your college. Very truly, "Jonas Smith."

He joyfully accepted the invitation after discovering that Jonas Smith was a very wealthy farmer, to whom the endowment of two chairs would work no hardship. After the dinner which followed the sermon the conversation came to the important subject in hand, and the farmer said: "Now, I know you can buy a good, strong, stout chair for fifty cents; but we want to do more than that for the college, and mother and me have decided that we are willing to give seventy-five cents each to endow two chairs, one for mother and one for me."



FORM "A" (FRONT).

FORM "A" (BACK).

Now, gentlemen, remember that everything about a foundry is very heavy (unless it be the profits) and hard on furniture; so if any of you consider the endowing of an extra shelf and stool for cost-finding it will be economy to procure the 75c style. A faulty system may leave you in the dark; a miscalculation may make a leak in the profits that is hard to trace. Your margin of profit is in

* Paper read at the A. F. A. Convention, June, 1904.

your books, and it is not only necessary for you to know whether you are losing or making money, but to know where you are making, or if losing, to get some idea how to stop the loss. Even though making money, there may still be some leaks which, if stopped, would increase the profits. A good system of bookkeeping, properly executed, is worth thousands of dollars to you. By this we mean sales and purchase ledgers with a cost system so interwoven that with each month's balance, they produce a systematic comparison of ac-

PROFIT COST SYSTEMS

VOUCHER-CHECK.

TO _____

FOR INVOICES AS FOLLOWS:

DATE	DESCRIPTION	AMOUNT	AMOUNT
	FULL VALUE OF INVOICE RENDERED		

ACCOUNT AND EXTENSIONS CORRECT _____ APPROVED FOR PAYMENT _____

GEN'L MANAGER

IF NOT CORRECT RETURN WITHOUT ALTERATIONS AND STATE DIFFERENCE.

FORM "B." (FRONT).

MAKE ALL ENDORSEMENTS BELOW

PROFIT COST SYSTEM CO.

No._____ LORAIN, OHIO,_____

PAY TO THE ORDER OF _____ $_____

_____ DOLLARS

TO _____ PROFIT COST SYSTEM CO.

100

_____ TREASURER.

FORM "B." (BACK).

curate detail costs, of each casting, each job or order or each class of castings, as the case requires.

The managers who look upon system as unnecessary red tape, are not managers of the shops paying the largest dividends. Their systemless methods require the most of their time attending to minor details, which under a proper system would be better cared for by an assistant at $10 per week. System has been termed "the ability to multiply ourselves in others." With this ability we have the large modern shops; without this ability, the old time establishments in which the matter of accounting is considered of little importance. If this truth be the sequel of the small percent of modern foundries of today, then it would certainly be economy to endow a 50-cent chair for costing, but remember a stronger one for 75 cents will give better satisfaction.

We may be able to keep a small business afloat without this systematic detail, but the same displacement that carries a small boat will not bear up a large vessel; if we aspire to a greater number of large prosperous foundries, we must set sail to catch the breeze, systematic accounting, that will waft us on. You improve and repair your

Cupola No. *Daily Charge Sheet* *190*

Product	Estimated Weight												Total
Total													
Charge													
Total													

FORM "F."

riggings, put in various kinds of molding machines, etc., but your way of accounting has run on and on without oil or repairs, until the old system is breaking down under the load. In fact if the bookkeeper asks for an extra card or form with which to patch it up, it is allowed only after considerable persuasion, and an extra clerk is not to be thought of.

Why continue this "improper saving of expense"? We have our organizations for everything except accounting, why not a section for cost-finding?

Repair and improve the worn-out methods, stop the friction, and you will be surprised at the amount of power saved and the ease with which your business will run. The advantages of such an organization would be many. Large corporations pay their accountants large salaries for their ability to systematize. Of course, the volume of business done by the majority of our foundries will not admit of a man of this ability as the head of their accounting, but some such method as suggested would be of assistance in the betterment of foundry accounting, or, an organization of this kind could have in its employ a man of this ability, to assist its members in formulating better systems for the handling of their business.

Materials Received, PROFIT COST SYSTEMS

Date Rec'd	FROM.	Via Frt. or Exp.	DESCRIPTION.	Weight.	Freight via C. L. & N.	Freight via N. Y. C. & St. L.	Exp.	INVOICE. Date.	Weight. Net.	Tons.	Lbs.	Amount.	Remarks.

FORM "C."

The point we have tried to make is this, that if you are trying to increase your profits by the little you can save by producing without ascertaining the cost, and just what constitutes that cost, you are working with too short a leverage; dividends are not made in that way. We are well aware that many are aroused to the need of this knowledge, but few are fully awake to the fact that the expense involved in finding the cost, means an increase and not a decrease in the dividends; that every dollar so expended, by a proper system, will return to your coffers twofold. For fear we have failed in making this plain, let us relate the actual experience of an economical (?) manager increasing the dividends for his company by using and re-using old nails. It was during the time when nails were selling at 90 cents per keg, that this economical manager had boys employed to gather nails out of the sand and straighten them; which the molders used in place of new ones. After an article published in the *Iron Age*, showing the small fractional cost of one nail, and setting forth the fact that if a carpenter receiving $2.50 per day dropped a nail upon the ground at his feet, the value of his time, required to pick up that nail, was greater than the cost of a new nail taken from his pouch; this manager, who, by the way, was operating a shop with some 400 employes, set about to find the cost of his second-hand nails, and was much surprised to learn that he was paying three times as much for old rusty nails as new ones would cost; needless to say, those boys were set at other work. This is but one of many similar experiences we could recite, but this simple one fully illus-

Record of Metal Costs for Month of 190

DESCRIPTION.	DATE	GOOD CASTINGS. Weight	GOOD CASTINGS. Amount	BAD CASTINGS. Weight	BAD CASTINGS. Amount	GATES, SCRAP, ETC. Weight	GATES, SCRAP, ETC. Amount	LOSS. Weight	LOSS. Amount	TOTAL CHARGE. Weight	TOTAL CHARGE. Amount

FORM "K."

Cupola No. 1												Total	Cupola No. 2											Total
ESTIMATED WEIGHT OF PRODUCT													ESTIMATED WEIGHT OF PRODUCT											
TOTAL CHARGE													TOTAL CHARGE											
GOOD CASTINGS													GOOD CASTINGS											
BAD CASTINGS													BAD CASTINGS											
								GATES AND SCRAP												GATES AND SCRAP				
								LOSS												LOSS				

Air Furnace No. 1 Heat No.							Total	Air Furnace No. 2 Heat No.							Total	Crucible Furnace	Total	Babbitt Metal	Total
ESTIMATED WEIGHT OF PRODUCT								ESTIMATED WEIGHT OF PRODUCT											
TOTAL CHARGE								TOTAL CHARGE								TOTAL CHARGE		TOTAL CHARGE	
GOOD CASTINGS								GOOD CASTINGS								GOOD CASTINGS		GOOD CASTINGS	
BAD CASTINGS								BAD CASTINGS								BAD CASTINGS		BAD CASTINGS	
				GATES AND SCRAP								GATES AND SCRAP				GATES AND SCRAP		GATES AND SCRAP	
				LOSS								LOSS				LOSS		LOSS	

FORM "L."

SHOP ORDER.

Please make Lorain, Ohio,

For On their Order No.

Description,		Totals
Date made,		
No. pieces cast,		
No. pieces good,		
Description,		
Date made,		
No. pieces cast,		
No. pieces good,		

Ship to

Via Shop Order No.

FORM "M"

trates the fact that "some expenditure is economy and some economy the wildest kind of extravagance."

The Kind of a System.

The writer has read many articles upon foundry-costing and with but one exception the subject was treated upon an estimating basis. The day of estimated costs departed in company with "large profits." The small margin of today demands accuracy and reliable detail. The costs are of small value which do not represent the exact expenditure as shown by the ledger balance; in other words, ledger balance costs. With these we not only know that nothing has been overlooked or omitted, but that no clerical errors have been made. With estimated costs there is no proof against any of these errors and no accurate profits can be based upon them.

I wish to correct the prevailing impression that a ledger balance system is an expensive one. If accuracy were required in many of the "come somewhere near" systems, the ledger balance system would in every instance require the least expenditure of both labor and money. With a ledger balance system you cannot say $6 \times 4.25 = 15.50$ and never know that that job cost you $10 more than your figures represent; everything must fill out a certain place and if too much or too little, you soon find it out. With a system of this kind, the chief desideratum of every entry is to know the cost of production. Each book, form and card used have in them the threads, which are automatically woven into the aggregate cost, which consist of as many different colors of thread or detail as required.

The first step towards a ledger balance cost system is the voucher method, for the handling of accounts payable; with this we include petty cost expenditures and payrolls, in fact all money paid away. A voucher system can be used without a ledger balance cost system, but the reverse is not desirable. Forms A and B make a very satisfactory voucher, plain and easily understood, yet giving all necessary information. Form A always accompanies an order with a request that invoice be

PROFIT COST SYSTEMS CO.

COST SHEET for Month of

	THIS MONTH		LAST MONTH		TO DATE		LAST YEAR
	No. Pcs. / Avg. Lbs.		No. Pcs. / Avg. Lbs.		No. Pcs. / Avg. Lbs.		No. Pcs. / Avg. Lbs.
	AMOUNT	AVERAGE	AMOUNT	AVERAGE	AMOUNT	AVERAGE	AVERAGE
MATERIAL							
Metal,							
Furnace Loss,							
Bad Casting Loss,							
Melting,							
Gates and Scrap Loss,							
Total,							
DIRECT CHARGES Molding Sand,							
Core Sand,							
Brick							
Accessory Castings,							
Core Oven Cost,							
Total,							
MOLDING AND CLEANING Molding Labor,							
Core "							
Direct "							
Cleaning "							
General "							
Total,							
SPECIAL CHARGES Machine Work,							
Defective Loss,							
Special Expense,							
General Charges,							
Total,							
Total Cost,							
Operative Labor,							
Total Hand Account,							
	POUNDS	PER CENT	POUNDS	PER CENT	POUNDS	PER CENT	PER CENT
Good Castings,	Lbs.		Lbs.		Lbs.		
Furnace Loss,	"		"		"		
Bad Castings,	"		"		"		
Gates and Scrap,	"		"		"		
TOTAL CHARGE,	Lbs.		Lbs.		Lbs.		

FORM "S."

rendered upon the accompanying blank. This is printed in copying ink, enabling the shipper to make an impression copy for his records, thus avoiding extra manifolding at either end of the line. When received from the shipper as an invoice rendered, it shows the order number upon which shipment of material, charged thereon, was made, date, car number and route of shipment. This is first used by the buyer who checks the price, makes note of shipment upon his copy of the order on

A book which is a purchase ledger, voucher record, and transfer journal combined, and known as an "Operation Record," is a labor saver, and if properly designed, a very satisfactory arrangement for any foundry business. This makes a complete record of accounts payable and contains place for the detailing of the cost of the various productions. A separate ledger is required for the detailing of material in stock, that is, pig iron, coke, coal, sand,

PROFIT COST SYSTEMS

CAST OF _____ 190 _____

No. and Size of Flask	No. and Kind of Molding Machine	No. of Pieces Cast	WEIGHT Good	WEIGHT Bad	MOLDER	MADE FOR	DESCRIPTION	SHOP ORDER	No. Pcs. Cast	SHIPPED	GOOD CASTINGS Pcs.	GOOD CASTINGS Weight	BAD CASTINGS Pcs.	BAD CASTINGS Weight	CHARGED

FORM "O."

which shipment applies and inserts auditor's charges. It is then passed to the receiving clerk, who checks the weight or quantity and marks date material is received. It now goes to the bookkeeper who checks the calculations and after numbering it, makes the necessary entries. It is then approved by the superintendent and passed to the stenographer who fills out a corresponding form "B" and returns both to the bookkeeper or auditor for certifying form "B." Forms "A" and "B" are now folded together and given to the general manager or president, who approves for payment

limestone, etc. Chaplets, facings and molders' supplies of all kinds, should be charged to an account known as "store" or "supplies," and put in charge of someone who delivers same to molders, as required, and makes report of all such deliveries, that said account may be credited and charge made against proper job.

All pig iron and coke of course is weighed when delivered to cupola and reported daily. Form "F" is designed for this purpose, where a variety of castings are made, requiring an entirely different

Name _____ Name _____ Name _____

Class of Work _____ Class of Work _____ Class of Work _____

DATE	WAGES PER DAY	TOTAL HOURS WORKED	TOTAL NO. PCS. CAST	WT. PER DAY GOOD	% BAD	DATE	WAGES PER DAY	TOTAL HOURS WORKED	TOTAL NO. PCS. CAST	WT. PER DAY GOOD	% BAD	DATE	WAGES PER DAY	TOTAL HOURS WORKED	TOTAL NO. PCS. CAST	WT. PER DAY GOOD	% BAD

FORM "P."

form "B," which is then passed to the treasurer for payment. Form "A" is now filed away and when form "B" is returned through the bank, it is filed with form "A"; thus not only making a complete record, but also rendering it impossible for the paying away of any money without the knowledge of the proper officials. Any number of "A" forms can be stapled and made up into one voucher, cutting off at line of auditor's charges, all except the last one, which bears charges and approval for all.

mixture. The lower part instructs the cupola men how the iron is to be charged into the cupola, and the top part gives the amount and kinds of iron charged for each job or grade of castings. Where the total cast requires practically the same mixture of iron, a more simple form answers this purpose. Forms "K" and "L" are used in compiling the cost of metal, cupola loss, bad casting loss, etc.

When an order is received, a shop order, form "M," is made, and customer's order

stamped "entered" shop order No. — which is then filed and ordinarily not referred to again. Upon form "M" is recorded daily the number of castings made from each pattern, and later the number which proves good. A shipping form is made in carbon at the same time form "M" is made out, ruled as to record dates and quantity of shipments made. When an order has been filled, forms "M" and "M1" are bound or filed together in numerical order. There is also a shop order card for following the work through the shop, made from the original order, for each pattern showing the number of pieces and kinds of metal required. Form "O" is a daily record of all castings made; the information for which is received by means of the shop cards. With this record is made a carbon copy for the weigh-master's or cleaning room's report of castings.

nation of a ledger balance system, and we will now refer briefly to the results obtained by such a system. This can best be done by a cost sheet form "S." The number of these sheets, each to represent a different job, or product, are without limit, and can be modified to suit any class of work. Separate exhibit sheets are made for melting cost, core oven cost and general charges; showing the details for the aggregate of these charges, which are prorated over the different products. The item "general charges" embodies salaries and office expenses, laboratory, taxes, insurance, water, light and power, crane service, molder's supplies, etc. Form "T" is the final or earning statement, one of which is made for each cost sheet, and which you will note, makes, identical with the cost sheets, a comparison with the preceding month, year to date and previous year to date.

PROFIT COST SYSTEMS _____ OPERATIONS, for Month of _____ 190____

	THIS MONTH			LAST MONTH			TO DATE			LAST YEAR, TO DATE		
	Pounds	Price	Amount	Pounds	Price	Amount	Pounds	Price	Amount	Pounds	Price	Amount
Stock,												
Made,												
Total,												
Used,												
Balance,												
Sold,												
Defective Lots,												
Prices Rec'd,												
On Hand,												
Total,												
Profit,												

FORM "T."

From form "O" is secured information for forms "K," "L," "M" and "P." Form "P" is designed for a molder's individual record, which by taking the average per week for each molder, as recorded by form "O"; each "P" form is printed on each side and so will accommodate the record of six molders for one year. This information could be conveniently kept in card form if preferred, but the sheet has some advantages over the card.

Form "C" makes a desirable receiving record for use in connection with forms "A" and B." The part shown is for local receipts; a very convenient arrangement is to have one part of the book for local and another part with a little different ruling for carload receipts, instead of separate books.

The Result Obtained.

Time will not permit a thorough explanation of a ledger balance system, and we will now refer briefly to the results obtained by such a system. This can best be done by a cost sheet form "S." The number of these sheets, each to represent a different job, or product, are without limit, and can be modified to suit any class of work. Separate exhibit sheets are made for melting cost, core oven cost and general charges; showing the details for the aggregate of these charges, which are prorated over the different products. The item "general charges" embodies salaries and office expenses, laboratory, taxes, insurance, water, light and power, crane service, molder's supplies, etc. Form "T" is the final or earning statement, one of which is made for each cost sheet, and which you will note, makes, identical with the cost sheets, a comparison with the preceding month, year to date and previous year to date.

The profit shown thereon monthly, is exactly what will be shown by the ledger at the close of the year. In fact each month is as much the close of the year, as is the twelfth month, so far as the books and earnings have to do with it. Supplies, fuel and pig iron are inventoried whenever the stock is low and product on hand checked monthly. The proper checking out of form "T" reveals any errors in billing, either in calculations or weight, or the failure to bill any shipment.

With a ledger balance system, each item, card, book, form, or whatsoever is a part of the whole and will form the grand results without any friction or commotion so long as each interested party performs his or her part, and this in itself prevents carelessness upon the part of any individual. All forms requiring the workman to per-

form clerical work, should be eliminated, and all entries should be so connected that no matter where you pick up a thread of information it can easily be followed to the start or finish. The writer was recently asked for the weight of a 30-ton electric crane, which had been installed and in service for eight years. The crane of course had not been purchased by weight, therefore it would be waste of time to refer to the invoice. The weight up until this time had been of no importance or special note made of it. How shall we find it? It is wanted immediately. Oh, yes! we can get that from the receiving book; let's see, that was purchased in 1896. In referring to the receiving record, we learn that it was received upon three cars, two of which were a double load and for that reason had not been weighed. The one car which had been weighed contained but a small part of the crane, but with this information the railroad expense bill was easily located which contained the weight of the entire shipment, and within ten minutes from the time this information was desired, we were in possession of it.

We only quote this instance to show what unexpected information a good system properly executed will furnish upon short notice.

"There's a vast difference," says someone, "between having a carload of miscellaneous facts sloshing around loose in your head and getting all mixed up in transit, and carrying the same assortment properly boxed and crated for convenient handling and immediate delivery."

THE SMALL CONVERTER PROBLEM.

BY ARTHUR SIMONSON.

The Tropenas Steel Process has been the subject of considerable discussion during the past year on account of its growing popularity, and the fact that two United States government arsenals have adopted it with the result of raising the general standard of specification for steel castings. Several contributions to the literature of the small converter have been made recently, including papers before two Foundrymen's Associations, which have been fully reported in the technical press.

Although the general subject of small converters would appear to have been fairly well ventilated, the nature of the discussions at the reading of the above papers, and the amount of correspondence that has taken place with the writer shows, what is quite natural to expect, that there are many points omitted in a prepared paper that appeal to practical men and on which they wish specific information. At the same time the nature of some of the queries indicates that, while considerable interest is aroused, there is a conspicuous lack of a general knowledge of the subject.

Probably the most important question raised is the one relating to the market which is open to the product. First of all, let us consider what the product is, and in making these statements let is be clearly understood that they are merely the results of long and current practice and can be duplicated with every plant erected if the process is carried out scientifically by experienced people. The usual commercial product then is genuine high grade steel of composition identical with the best open hearth steel, high in tensile strength and ductility, sustaining from 60,000 to 80,000 pounds per sq. in. tensile strength, with an elongation of from 25 to 35 percent on 2 in. The bending test is from 90° to 180°. It is capable of being run into the lightest and most intricate shapes, is perfectly sound and free from blowholes and can be welded.

Outside of this general grade of steel every class of special steel is made with regularity, and convenience surpassed by no other process. Unfortunately for the good reputation of the small converter, owing to its comparatively recent advent, it is in some cases being run by inexperienced persons, and there is being put on the market as the best product of the small converter some very bad castings indeed. At the same time semi-steel and other materials with curious names and still more curious properties, are being sold and bought very extensively as steel. The first impression of a buyer when hearing of the Tropenas steel for the first time is that it is only another of these hybrid metals or modified cast iron, and salesmen are confronting this all the time. Of course the first piece he sees if submitted to any kind of a test, physical, chemical or microscopical, is convincing, but the trouble is that the ordinary buyer of small steel castings does not go into it so deeply and if he finds that the castings are more or less malleable, and cut something like steel he is satisfied. Tropenas steel is not semi-steel, and any comparative test will prove it.

The chief points of recommendation are the regularity of the material, the cheapness of the plant and the convenience of handling. This

in spite of statements that have appeared to the effect that a Tropenas plant is costly and the process wasteful. These statements will be shown to be erroneous in the course of this article. It is today an indisputable fact that a small converter plant manufacturing castings for the trade is a paying proposition if handled by men of experience in the general branches of steel foundry practice. It is not in the cost of the fluid steel in the ladles that the cost of production can be materially cut, because on the same tonnage basis Tropenas steel is made as cheaply as open hearth steel. But in its subsequent handling, the cost of molding, cleaning, and the removal of heads and gates there is room for a great deal of ingenuity and good management that is conspicuous by its absence.

In discussing the subject of the market we have to consider the different means available for producing steel castings and how nearly they meet the total requirement. What is their relative cost, what are their shortcomings, and are they all, or any of them, overcome by the small converter? Above all, how does the cost of the small converter compare with the other means at our disposal? The bulk of steel castings in use at the present time are made either in the crucible or the open-hearth process. The crucible process is purely a melting process, no refining is accomplished, and it is necessary to use the finest raw materials and those which are exactly suited to the composition of the steel required. You simply get out of the crucible the approximate average of what you put in, with slight losses or gains in certain elements.

Whilst a crucible plant is not very expensive its cost of maintenance is high and the crucibles which are useful for very few heats are quite costly. This coupled with the necessarily small output makes crucible castings very expensive. There is no doubt that the crucible can make the very best castings and very small ones, and therefore when it is a question of obtaining very small, high grade, genuine steel castings, and price is a secondary matter, this process meets the requirements. Its disadvantages are exceedingly high prices, small output, and the castings as a rule are comparatively hard. The open hearth process holds an unassailable position for the manufacture of almost every class of castings, its capacity is becoming greater all the time and the quality of the material produced is very high. But the cost of an open hearth plant is enormous, it must be kept going continuously to its full capacity to be economical, and it is quite unsuited to the manufacture of small castings. We have then in a nutshell, the open hearth which is cheap but unhandy, and the crucible which is very convenient but costly. We need the happy medium, and the small converter supplies it. The castings are cheaper than crucible, but as a rule slightly dearer than open hearth, the capacity of the small converter is much greater than the crucible and it can make any casting which the open hearth can not. Obviously then there is a very extensive market.

The next point on which a good deal of discussion has arisen is melting stock. It seems to be the impression of some people that suitable melting stock is difficult to obtain. This is not so. The pig iron used is low phosphorus pig, and there is always plenty of it in the market, and silicon over two percent and under four is not hard to obtain. The writer has never experienced any difficulty in obtaining all necessary pig iron, and by a judicious mixture of two or three kinds it is possible to make any desired composition. The amount of steel scrap that may be melted in the cupola to give good results has been asked for and many opinions expressed. The fact is that any amount may be used under certain conditions, and these conditions alone must determine the amount. What is the object in melting steel scrap in the cupola? It must be either that steel scrap is cheaper than pig iron, or it is used in order to use up defective castings, risers and gates. If the class of work or long experience of the operators enables them to make very few defective castings and cut down the risers and gates to a very small percentage, and if foreign scrap is high a small proportion should be used and vice versa. It is a question of economics, there is no technical difficulty in using up to fifty and even sixty percent. The writer is at present manufacturing a class of work which makes so little scrap it is impossible to supply the necessary amount and foreign scrap is used continuously. It is better as far as possible, on account of the problematic and often questionable quality and composition of foreign scrap, to make the plant self supplying, and in good practice the scrap made should not exceed 25 to 30 percent of the cupola charges.

The only thing to bear in mind is that the metal tapped out of the cupola, which is to be put into the converter and blown must have a chemical composition varying only between

certain limits. It does not matter what the cupola charges are made up of so long as they give this result, and it is for each operator to decide what will be the cheapest way for him to make up those charges.

The next point of interest, and one of great importance, is the one relating to wastes and losses in manufacture. It has been reported as the experience of different parties using small converters that the unreclaimable loss, that is the losses by oxidation in cupola and converter, runs as high as 3 percent, to say nothing of the amount used as shrink heads and gates. It is apparent that under such conditions the process could not possibly pay, and as any such losses are most emphatically not necessary to its successful working, it only remains to say that any operator making such losses should either improve quickly or else gravitate out of that particular foundry.

The loss in a small cupola, such as is commonly used with the process, from 30 in. to 40 in. diameter is about 5 percent, or not much either side, the causes of which are too well known to need any recapitulation. The losses in the converter consist of about six percent of carbon silicon and manganese *purposely burnt* out of the metal in order to raise its temperature to the very high point necessary to run the small sections and about 4 or 5 percent of iron consumed during the process. The carbon silicon and manganese in the pig iron constitute the fuel and nothing but atmospheric air is blown into the converter. Further waste and expense may be caused in the method of adding the final additions used to recarbonize the steel to the desired point. The common method is to melt the final additions in a crucible or small cupola or to heat it to redness in a furnace. But if the process is handled properly the steel will be hot enough to melt any amount of final additions commonly required by adding in the cold state and thus getting the full benefit without any loss.

It is said that considerable loss occurs through the projection of iron from the mouth of the converter during the blow by the violence of the reaction taking place within, and it is said that a patent has been granted on a converter with special tuyeres intended to be opened when any violent reaction takes place and by blowing these projections downward and against the side of the converter prevent them from blowing out of the mouth. This seems like using the pound of cure when an ounce of prevention is not only better but easily available. If the composition of the metal is right and the operator knows his business there will be no projections of iron at the converter mouth, but only small globules of slag and these not more than enough to fill a bucket in the course of a blow.

The matter of durability of converter linings is a question that has caused a good deal of discussion, because it is apparent that a lining which will stand the intense heat and the chemical action must be very refractory and pure. The chief cutting action on the lining is caused by the oxide of iron formed during the blow and its greatest effect is felt in the neighborhood of the tuyeres where it is produced.

The converter may be lined in a variety of ways and with numerous forms of material, although all are of similar composition. In Europe large special shaped blocks of high grade silica brick are used and by this means converters can be very quickly lined and the objection of having many joints between the bricks is reduced as much as possible. The disadvantage of this method is the cost of special bricks and the fact that when making repairs it is necessary to cut away sometimes a good quantity of unburnt or partially burnt brick to fit in the new ones, and this means waste.

In America, where the converters are lined with brick, the common square, arch and wedge are used and the lining is generally put in double, so that when the first row is burnt out a new one is put in. This method has the disadvantage of being slow, it makes very many joints and as the lining does not burn out evenly an amount of good brick has often to be cut out in making repairs. By these methods a converter may be made to last 1,000 or more blows without relining completely to the shell, and the tuyeres will have to be renewed every 100 to 150 blows, depending on what opportunities offer for repairing them. There is another method of lining which is probably the cheapest and most economical of all. That is to make the lining by ramming a silicious material around a collapsible metal form, which is afterwards withdrawn through the mouth of the vessel. The tuyeres may be also formed of the same material integral with the lining by placing tubes in the correct position and afterwards withdrawing them. Repairs are then made by putting in the form and ramming in the material against the face of the existing lining without having to cut and waste anything and there are no joints.

The following are some interesting and

pointed questions that have been asked the writer. As they have probably occurred to many others it would seem that an attempt to answer them here would not be out of place.

(1) Will the metal run small gated patterns such as are made at present in malleable iron? There are undoubtedly many patterns made in malleable iron that it would be practically impossible to run in steels under any conditions. The writer has run strips 8 x 1½ x ⅛ inches as a test for fluidity and from this an idea may be gained as to what can be done.

(2) What is the greatest difficulty in the process?

In answer to this it may be said that there is no greater difficulty in handling it than in any other steel making system. There are no gas producers, and no regeneration system and all the training that is necessary is in the ordinary requirements of a foundry— the making of cupola mixtures by chemical analysis and the judging of the flame by actual experience gained by watching a number of blows alongside of some one who is thoroughly posted and can point out the indications.

(3) What is a good average production of steel per day in working regularly? What is the maximum production that might be kept up say for 2 or 3 days?

With a plant consisting of one converter of two tons capacity and blowing every day, making the repairs to the lining at the week end, about six blows a day, equivalent to about twelve tons of steel, would be a very fair production. For two or three days it would be possible to make 10 or 12 blows a day. If such a quantity is required it is much better to have two or three converters as it is then possible to run two converters at the same time and have one always under repair. With three converters an output of 600 tons per month of finished castings is easily available.

(4) Can the Tropenas system be run successfully with converters of 1,000 to 2,000 pounds capacity?

Converters of that size have been built and run as successfully as could be expected considering the physical difficulties of handling such small quantities of molten metal. Anyone familiar with steel foundry practice will appreciate the fact that such small quantities of steel have to be handled so quickly that it is not convenient. No matter how hot the steel is to commence with it soon chills. Practically the same number of men would be required to handle it, repairs are more difficult to make, and the small output renders it uneconomical. The two-ton vessel has been found to be the most convenient size and greater output is secured by increasing the number of vessels.

HEAVY FOUNDRY WORK.

The accompanying illustrations show the method of molding some very large castings at the plant of the William Tod Co., of Youngstown, O. The work was done for the Lackawanna Steel Co., at Buffalo. The data given is in connection with the molding operations carried out under the direction of L. A. Woodard, works manager of the William Tod Co., in the production of the large bed made for the 54 x 66-inch, three bearing reversing engine built by this firm for the steel company, and also the casting of a very large cylinder. The Youngstown company has also installed recently a 54 x 66-inch return crank reversing engine for the Republic Iron & Steel Co. in that city. The two engines are said to be the largest of their type that have yet been built.

When the William Tod Co. first drew up the design of the 85-ton bed the matter of subsequent shipment was an important factor in the preliminary plans and was discussed with the railroad company in detail. It was found necessary to have a special car made to carry this load, as well as some other heavy shipments expected from time to time. Fig. 1 shows one of these cars with a capacity of 75 tons and arranged with a pit for the conveyance of heavy wheels. Fig. 2 shows the bottom of the bed and gives a fairly good idea of the overall dimensions. The illustration exhibits also the full bearing which the bed has on the foundation, with the exception of the openings required for removal of the cores.

The casting is 33 feet 5 inches long and 12 feet 1½ inches wide, or 12 feet 1½ inches high as loaded on the car, and weighed when cleaned 85 tons. The weight of the bed is thus seen to be greater than the rated capacity of the car but this excess is met by the generous margin made for possible overloads. The extreme height of the bed from the bottom of the oil pan to the top of the rib on the guide barrel is 9 feet 10¼ inches.

By a reference to the sketch, Fig. 3, illustrating the method of molding, it will be seen that the bottom of the mold was made in loam and the sides in dry sand. The mold was covered with two loam plates, K and L, while the bottom of the mold was built up on heavy cast iron plates, M, N and O, provided with lugs

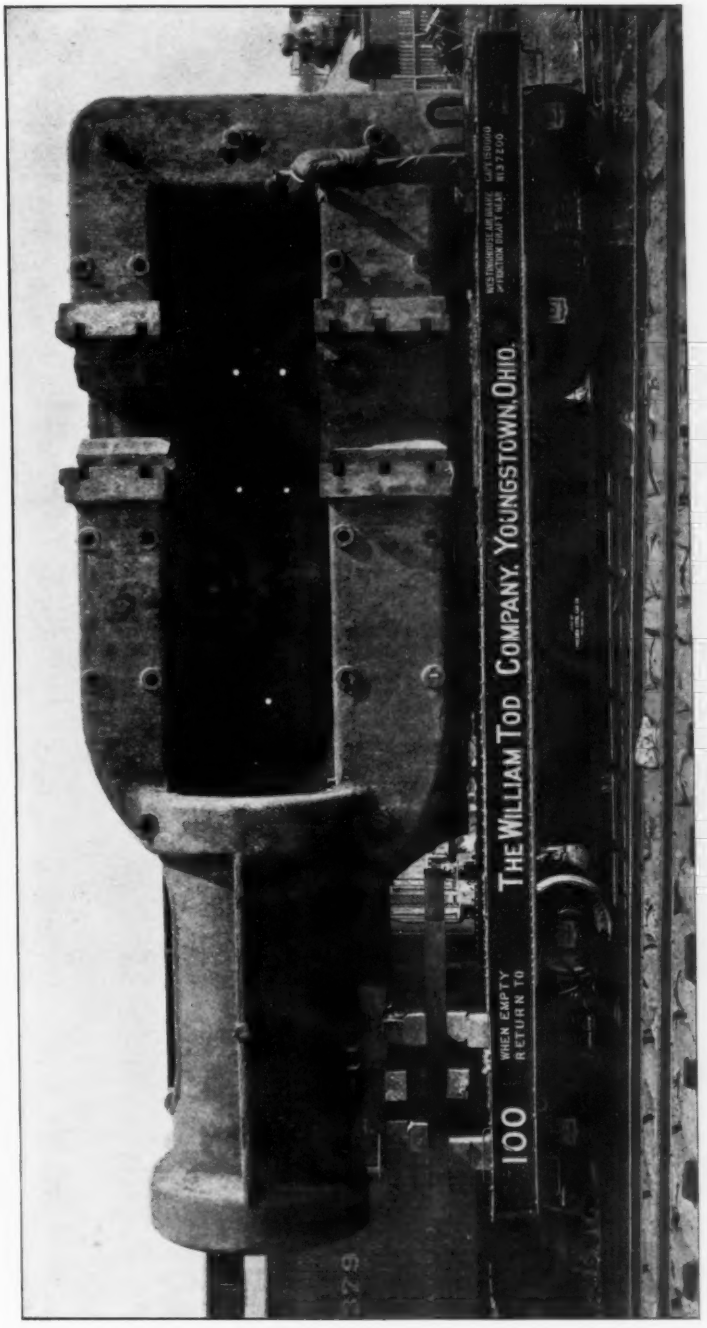


FIG. 1—85-TON CASTING FOR 54 X 66-INCH, THREE BEARING, REVERSING ENGINE.

on the sides for the bolts used in holding down the top plates. The cylinder end of the bed being circular, it was necessary to cover this part of the mold with a flask G which is held in place by the top plate. The extension under the main bearing projected above the rest of the mold and therefore needed the use of a flask H. This projection materially increased the upward pressure on the top plate. Some conception may be had of the amount of this upward pressure when the reader considers that the weight for simply holding down the

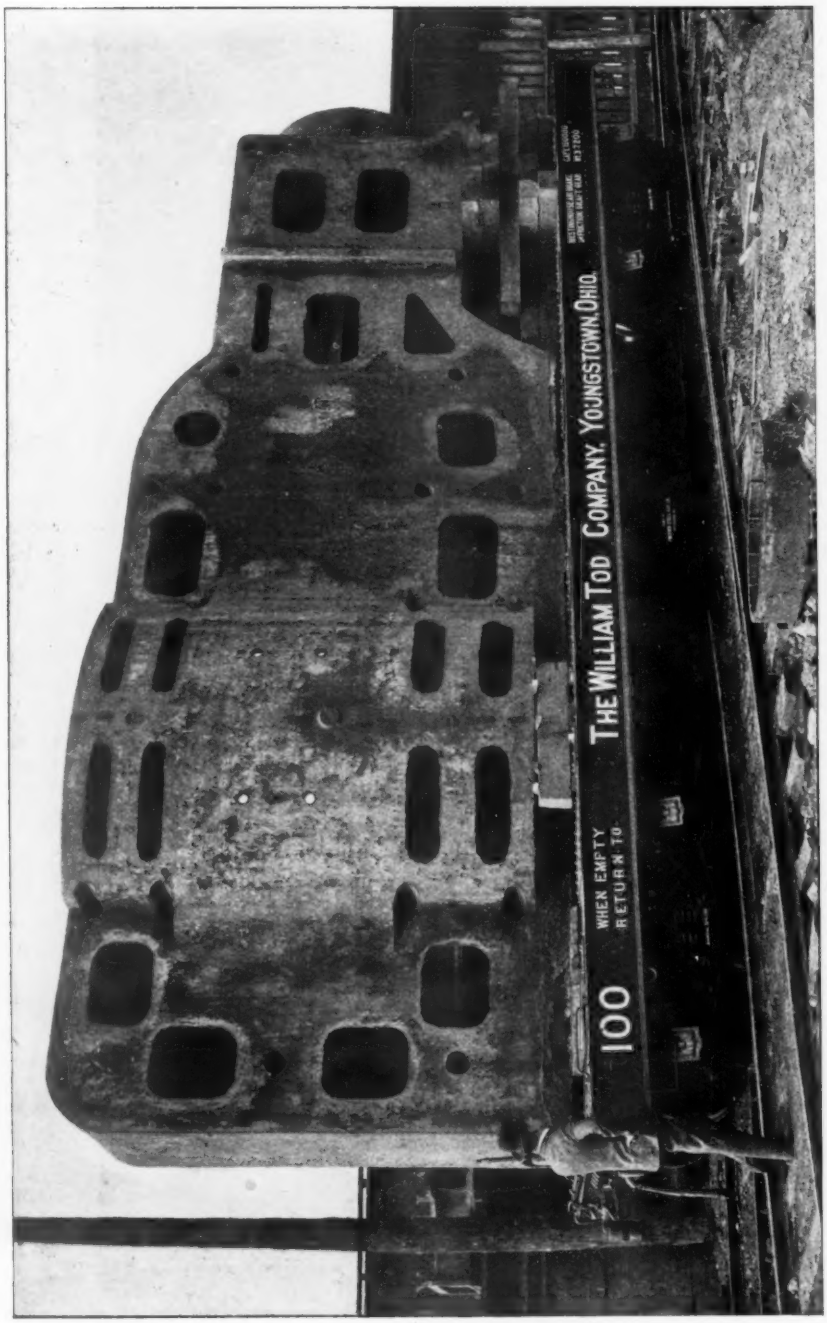


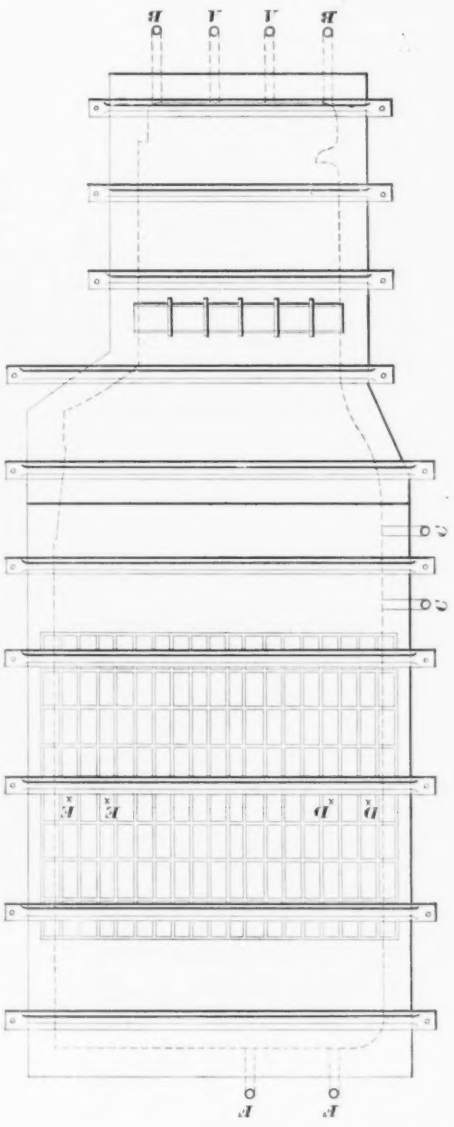
FIG. 2.—ANOTHER VIEW OF THE 85-TON ENGINE BED.

cores on this job is in the aggregate 175 tons. The top plates were held down by ten large cast iron binders tied to the foundation plates by 20 1½-inch bolts and in addition to this grip about 75 tons of weights were piled on top of the mold.

Across the bottom of the bed under the guide barrel there is a rib about 6 inches deep which almost cuts the top loam plate in halves. Five wrought iron staples were cast in this top plate for strengthening and binding the portions together and inside the staples four

plates were placed for holding the sand over the rib.

The mold was gated in five places and fed at A A and B B from a 35-ton tank, at C C from a 25-ton ladle, at D D from a 6-ton ladle, at E E from a 10-ton ladle and at F F from a 13-ton ladle. With all the ladles pouring at the same time four minutes were required to fill the mold. The casting was poured without any accident or mishap and came out of the mold in perfect condition, a decided compliment to the skill involved in such an undertaking.



Another casting of massive proportions weighed 88,800 pounds in the rough and is illustrated in Fig. 4. The mold proper for this 110-inch Corliss cylinder, casting and mold shown in Figs. 4 and 5, was bricked up on a heavy loam plate placed in a pit about 4 feet deep. This loam plate had lugs along the sides through which the bolts were passed for tying down the mold. A seat was swept on

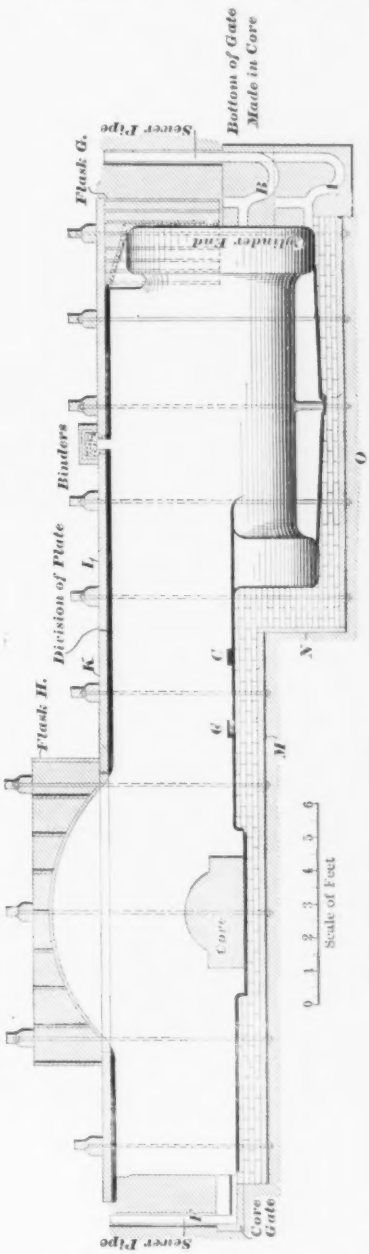


FIG. 3.—PLAN AND SECTIONAL ELEVATION OF MOLD FOR 85 TON ENGINE BED.

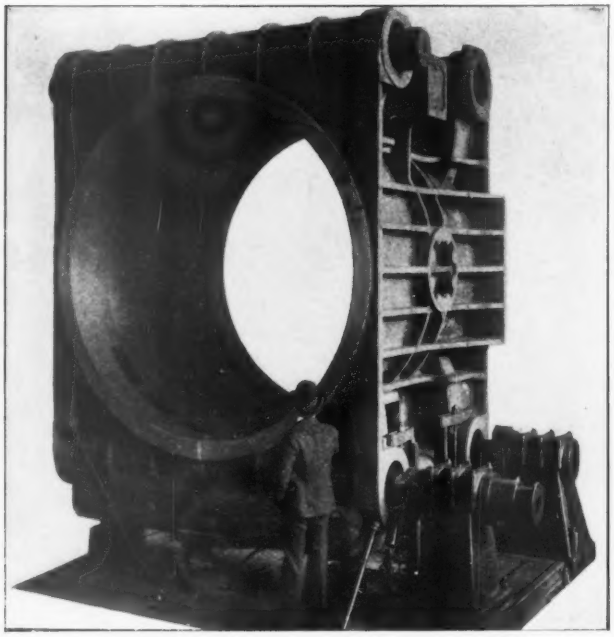


FIG. 4.—CORLISS ENGINE CYLINDER, 110 INCHES DIAMETER AND 60 INCHES STROKE.

this loam plate for the brick center core which was swept up on a loam ring having lugs on the inside for lifting purposes. The center core was next removed and the pattern placed in position on the loam plate for bricking up the inside of the mold.

The wrist plate side of the mold as well as the side opposite was bricked up stationary on the bottom loam plate. The steam and the exhaust chest sides of the mold were bricked up with face plates which were then removed in order to draw the steam chest patterns and for the task of setting the steam and exhaust chest cores in position.

The top of the mold was formed by an iron flask and dry sand. This cope was securely held down by binders through which bolts were passed to the lugs on the bottom loam plate already mentioned. The two removable face plates forming the steam and exhaust chest sides of the mold were securely held in position by binders and tie bolts. A heavy sheet iron curbing was employed and the space between the curbing and brick filled and securely rammed.

Fig. 5 shows that the cavities extend in and

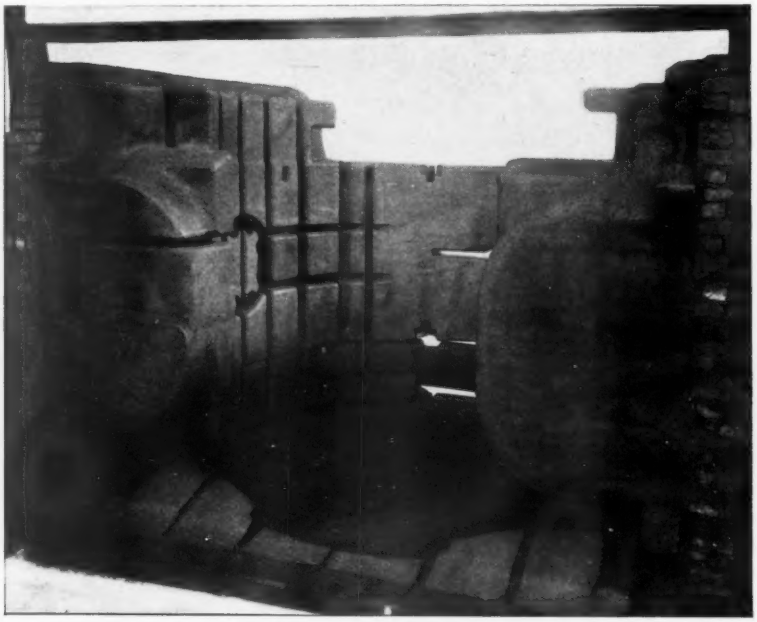


FIG. 5.—MOLD FOR CORLISS ENGINE CYLINDER.

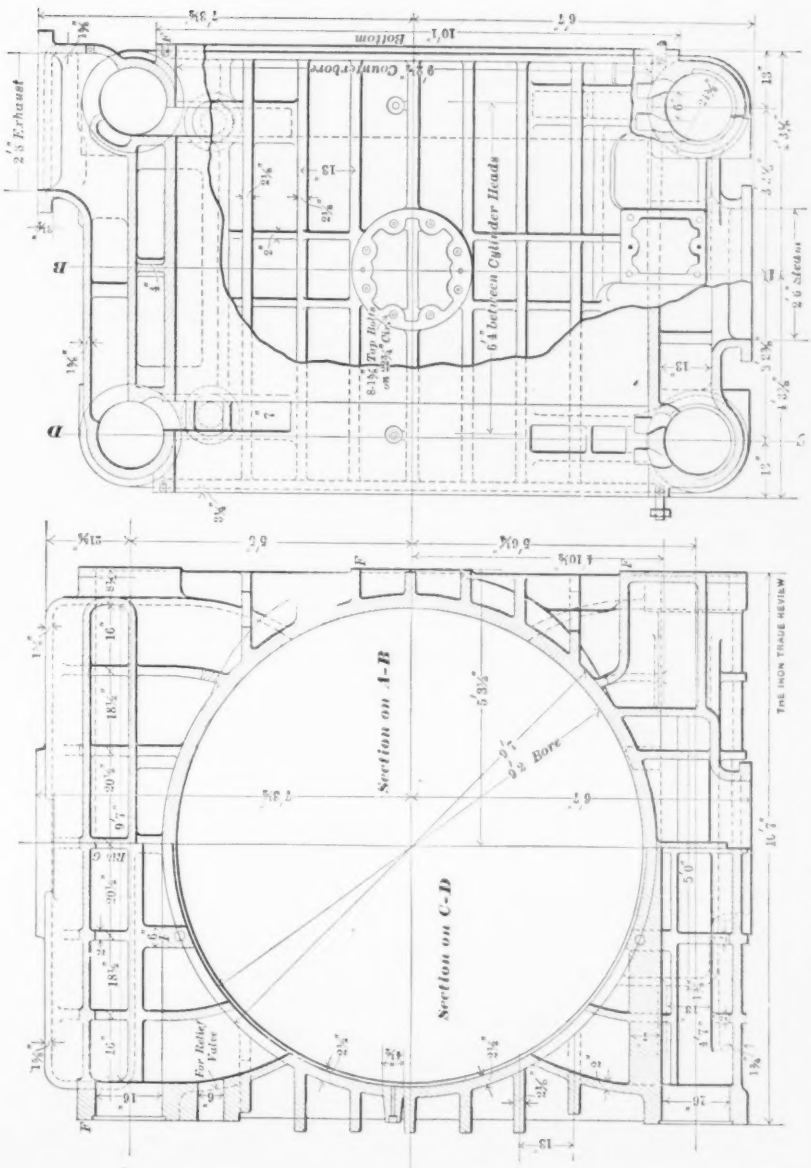


FIG. 6.—END AND SIDE ELEVATIONS, PARTLY IN SECTION, OF CORLISS CYLINDER.

around the steam chests to a considerable depth from the sides of mold. The brick work was supported in these cavities by plates projecting in and from the side walls of the mold. The cylinder was poured through four down gates, each having three inlets to the mold. One inlet was at the bottom leading in at the bottom flange of the cylinder, the other two inlets located one-third and two-thirds of the way up respectively to top of cylinder and leading into the ribs shown on the side. The dimensions of this cylinder given in Fig. 6 will suggest the magnitude of the work, and incidentally the statement may be made that the second cylinder of this size has just been cast with the same gratifying success.

Benj. Middleditch, of Detroit, Mich., has removed from 98-100 Iron street, to 97-103 Meldrum avenue. His new plant is 50 x 100 ft. He is installing considerable new machinery, which will increase his capacity and enable him to carry on his business of brass founder and finished to much better advantage.

METALS IN FOUNDRY PRACTICE.

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

We are glad to announce that the Cast Iron Notes, as formerly, will be written by Mr. W. J. Keep, and also that we have secured the services of the following well-known experts to answer inquiries along their special lines:

J. B. Nau, Metallurgy of Steel and Steel Castings.
Dr. Richard Moldenke, Malleable Castings.
C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

To Make Iron Fluid.

Question: In our foundry we require very fluid iron. Our Spanish casting iron is not fluid even at a very high temperature. Is an increase of phosphorus needed and if so how shall we get it? Should it be added in the ladle of cupola?

Answer: This is a question to be settled by a chemical analysis. When you find what your castings contain, you can tell what they need. Probably they need silicon more than phosphorus. If you procure some ferro-silicon containing about 8 percent silicon and 2 percent of phosphorus, begin by adding 10 percent to your mixture and increase until your iron is fluid and your castings are sound. An iron mixture for your purpose should contain 3.00 percent silicon and 1.00 percent phosphorus. This amount of phosphorus will strengthen your castings by lessening blowholes. If you cannot get this much phosphorus you will find that the increase of the silicon will give you fluidity. There is no way to add phosphorus or silicon except to purchase a pig iron containing it and add it in the cupola.

Chill Blocks.

Question: I have had considerable trouble in casting gray iron on chill blocks on account of these blocks becoming cracked. Some of the blocks are quite expensive and it has been the custom to continue using them after becoming cracked, keeping them free from rust by an application of oil just before using which collects in the cracks and makes the casting rough. What analysis should we make of these chill blocks?

Answer: Have the silicon about 2.50 percent and the phosphorus and sulphur as low as you can get them. The higher the carbon the better, and it should be nearly all graphite. After casting and while the chill blocks are warm, rub the cracks full of asbestos cement—that you can get from The American Seal Paint Co., of Troy, N. Y. It will become hard in a few minutes. Sandpaper smooth. Simply moisten the chill with oil.

Iron for Cylinders.

Question: I have irons of the following analysis, how can I mix them to get a clean cylinder. They now come spongy and dirty, as though there was too much sulphur.

	Silicon	Phos.	Sul.	Mang.
W—No. 2	1.50	.20	.05	.70
N—No. 2	1.95	.50	.02	.50
D—No. 2	2.25	1.30	.035	.50
T—No. 4	1.50	.90	1.06	.90

1,000 lbs. of old car wheels to each charge. How can I clean the iron in the furnace or in the ladle?

Answer: The analyses are not at all correct. The phosphorus in W— would be Max. .70. No iron ever had 1.06 sulphur. You cannot mix by analysis unless you know the correct composition of your pig irons and of your scrap. You will be obliged to use some other method for making your mixture. You do not tell what thickness your cylinder castings are that I may tell you what their composition should be. If you multiply the pounds of each iron in your mixture by the percentage of silicon and add these together and divide by the total lbs. used, you will get the silicon in the mixture. Subtract .25 to get the silicon in the casting. If you want a different amount of silicon you can see which irons to vary and figure it over again.

You can treat all other elements in the same way. Add .03 to the sulphur and take .10 from the manganese obtained.

Your cylinders with your present mixture must be very hard. You can add to your present mixture a silicon iron with from 6.00 to 8.00 percent until the iron is soft enough and until your castings are sound.

If you want the castings still softer use clean machinery scrap instead of the old carwheels.

Castings One Side Hard and One Side Soft.

Question: I have some castings to make which are 24 in. wide, 26 in. long and 4 in. thick. One side must be as hard as possible and the other side must be planed. Using a

chill does not harden the metal deep enough. The back must be soft, as it must be planed true. If I use chills on both sides would the casting be perfectly true so as to need no planing and will the chill stay straight?

Answer: You can make the chill deep enough if you use the high chilling iron. Suppose you use old carwheels. The back would be soft enough to be planed. Two chills would be difficult to use.

Dull Iron and Slow Melting.

Question: Our heats are not over 3 tons per day. Iron charges 1,000 lbs. to 150 lbs. coke. Coke bed 500 lbs. The first 500 lbs. of iron is not very hot—a cherry red—then it comes white, but melts very slowly—one and one-half hours to melt the three tons. The inside cupola diameter is 30 in. There are 7 tuyeres 15 in. above sand bottom. We use a fan blower at 3,000 revolutions per minute. Our charges are 500 lbs. No. 1 Norway pig, 350 lbs. Niagara, 150 lbs. scrap. Our castings are mostly pump work with a little heavy job work.

Answer: This is not slow melting. The speed could be increased by using less coke between charges if the iron would be hot enough—100 lbs. of coke should be enough. By increasing the coke on the bed the iron would be hotter. Your iron being dull at first and becoming hot before the first charge is melted would indicate that you did not heat your cupola hot enough before you charged your first iron. Light your cupola a little earlier. You should have about 12 or 14 ounces of blast.

A Founder With No Experience.

Question: I am just starting a small foundry. What kind of pig iron will make close, clean, soft and strong, light machinery castings and other light specialty castings? Can you keep slag out of iron? How can you keep blow-holes out? Can you take ordinary R. R. or House scrap iron and drop something into it and make it soft? Can you drop something into soft iron to make it hard? What kind of iron should I use to make a soft iron with shrinkage .125 or .130, strength 475 to 500 lbs. for a ½ in. square test bar? How high should the tuyeres be from the sand-bottom? How deep should the sand-bed be? Should there be any fire clay mixed with daubing to patch cupola after each heat? Should I use limestone in a 27 in. cupola?

Answer: Any non-chilling pig iron will make good light machinery castings if you purchase irons that when melted together will contain about 2.25 percent silicon. If you want to have very sharp castings have phosphorus about 0.75 percent and use good coke with sulphur below .075 percent.

If you can melt all the iron you need in your 27-in. cupola you do not need to use limestone. If you want to get all the iron possible out then use about 5 lbs. of lime to each charge. The tuyeres must be high enough to let the hearth hold the iron you need for any one casting. The sand-bottom should be about 4 in. deep. Daubing is made of fire clay and sharp sand. If you melt your iron hot you will have no slag or blow-holes. Mix a high silicon iron with R. R. scrap or miscellaneous scrap in the cupola, but stove plate scrap alone will not make soft small castings. Vary the silicon of your cupola mixture to make your castings hard or soft. With silicon 3.25 and phosphorus 1.00 percent shrinkage of a ½ in. test bar will be about .125. 400 lbs. is a good strength and it would be difficult to get 475 lbs.

Remark: We would advise your getting a partner who has had experience in these things if you want to succeed in the foundry business.

BRASS FOUNDRY NOTES.

Chills or Iron Cores for Brass Castings.

Question. I wish to ask for information in regard to casting composition or brass upon chills or iron cores. I have tried about every kind of coating and wash, such as white lead, whitening, oil and plaster of Paris, but in all cases have trouble from blow-holes.

Answer. If the chill or iron core is to remain permanently in the brass casting, a sure preventative of blow-holes is to heat the iron before introducing it into the mold. The molds are left open on the floor until pouring time, when the heated irons are placed in position, and the molds quickly closed and poured. If the iron part is polished or turned bright, heating is unnecessary on small castings, and the molds may be handled the same as ordinary core molds, but if the chills must be removed from the casting, some coating is necessary to prevent sticking or burning on. For small castings, such as door handles, the iron core is oiled with linseed oil, while wet sprinkled with dry lake sand, and then dried the same as any other core. On

large chills where cores made according to the above might blow, the writer has used with success a coating of plumbago mixed with glue. The idea, of course, is to get a coating that will adhere to the chill, be fireproof and give off the least possible amount of gas. In all cases of casting such chills in brass the method of gating is as important as the coating. The metal must enter the mold at its bottom and gently rise so as to envelop the chill, thus giving the gas a chance to burn off and not get entrapped in the metal.

C. VICKERS.

Trolley Wheels.

Question. What is a good mixture for trolley wheels for an electric car? Also, if it is desired to bush these wheels so as to reduce friction and increase the wear of the bearings, what should be the composition of the bushings?

Answer. Almost any alloy is used for trolley wheels, from copper to common red brass, the idea in using copper being of course to secure the highest efficiency in electric conductivity—common red brass is used because it wears out quickly—but it is not every founder that can use it, because it is necessary to own both a brass foundry and a street railway. Generally, however, a hard bronze is used by ordinary individuals and it is often too honest a metal for the money they get for such work; anything from "eight to one" to "five to one" can be used.

A good alloy is

Copper	16 pounds
Tin	2 pounds
Zinc	8 ounces
Lead	4 ounces

To 75 pounds of this mixture add 6 in. of stick phosphorus. 2. Steel is quite often used to bush the wheels, sometimes an exceedingly hard alloy of bronze. The attempt to produce a superior wearing article has evolved several patents. One manufacturer introduces roller bearings, and another casts a cavity inside the hub, which he packs with a composition, in which graphite predominates.

Large numbers of trolley wheels are cast in the alloys above suggested and wear well without bushing.

C. VICKERS.

Chemical Pumps.

Inquiry. We have made 70 or 80 chemical pumps (brass) that weigh 1,162 lb., and they have all turned out well, but when we attempted to make a smaller one, which weighed 94 lb., the metal ran through the core just as it would in old molding sand. The question is, why is it that we have no trouble with the cores in the larger pumps, and so much trouble with the smaller ones? Both are made out of the same core sand, and are poured of the same metal. Could you tell us what the difficulty is or what core mixture would prevent it?

Answer. Perhaps I can answer this inquiry better by giving a leaf from my own experience, as it brought vividly to my mind similar troubles with which I have had to contend from time to time.

We had been making brass castings in which an inch and a half core was surrounded by from 3 to 6 in. of metal, and when we first commenced the metal permeated the core precisely as stated above. When the castings were allowed to become cool in the molds, we invariably failed to clean out the cored cavity, so I used to take them out hot (a dull red) when the hole was easily cleaned out. Castings that had become cold I reheated.

Naturally I wished to prevent such trouble, so I experimented with all the core mixtures I could think of, and I guess I tried them all from "flour sand" to oil, and one was no better than the other. So when I got tired of experimenting with the core sands, I began with plumbago, and found that a couple of coats of a first-class article made the core "metal tight," so I recommend the same remedy in the case of the pumps.

I cannot rid myself of the idea that those small pumps were poured unnecessarily hot. A core may be protected with the finest plumbago obtainable, and yet if set in a heavy casting, may be burned in solid provided the metal be poured too hot. In a heavy casting there is no need of pouring hot, as suitably placed gates and feeders will insure against shrinkage. Now, why is it there was trouble with the cores in the small pumps, and no trouble at all with the large ones, the metal and core mixtures being the same?

To intelligently answer this, one ought to have some idea of the respective sizes of cores, and the thickness of metal in which they were embedded, as the difference in the weight of the two sizes of castings tells nothing of itself.

If the thickness of metal in the small pump was greater in proportion to the diameter of the core, than in the large pump, then the small pump would be harder on its core than the large one, and the same holds good of any brass castings as far as my experience has gone.

For instance, a 1-in. core set in metal 1 in. in thickness needs no special protection, but a ⅛-in. core, surrounded by 1 in. of metal does require protection to insure a clean straight hole. Other things to be considered are heat of metal and height of pouring head. To sum up, avoid too high a head, also pour cool and coat the cores with plumbago as aforesaid. C. VICKERS.

STEEL FOUNDRY NOTES.

Steel Castings.

Inquiry. I should like to know what equipment would be necessary for making a limited number of steel castings, mainly by remelting scrap cast steel.

Answer. It is rather difficult to give a precise answer to such a vague question, but in general I may say that for a limited number of steel castings the Piatt furnace is often employed. This furnace is mostly built for one single crucible that can contain as much as 600 pounds of metal or less. The crucible in pouring is not removed from the furnace. This latter, being portable, is lifted up with its crucible, and the steel poured from a spout attached to the furnace.

The crucibles employed in such an operation are made of a mixture of refractory clay and graphite in varying proportions. Information in regard to them will be furnished by crucible manufacturers.

For very small outputs, as would seem to be the case with the correspondent, the Siemens furnace would be too costly. Whenever a dozen or more crucibles are used in one operation, the Siemens furnaces are the most economical.

J. B. NAU.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care of J. W. Paxson Co.

The October meeting of the Philadelphia Foundrymen's Association, held at the Manufacturers' Club, was the 140th meeting of this organization. It was devoted to a discussion of the proposal to form a foundry foremen's association. The outcome was a decision to form such an organization, and a meeting will be held on Wednesday evening, Oct. 19, at the Manufacturers' Club, to elect officers and adopt a constitution and by-laws. At the meeting of last week, A. T. Williams, foreman of the Enterprise Mfg. Co., Philadelphia, was chosen temporary chairman; W. P. Cunningham, foreman of the steel foundry of the American Bridge Co., Pencoyd, Pa., was made temporary secretary and treasurer. The following committee was appointed to draft a constitution and by-laws: James B. Strain, foreman Robert Wetherhill & Co., Chester, Pa.; John P. Cunningham, American Bridge Co., Pencoyd, Pa.; George P. Benhert, foreman Williamson Bros. Co., Philadelphia. It is expected the new organization will start with about 20 members. The objects of the Associated Foundry Foremen, the organization which has been instrumental in starting the various local associations of foremen, are stated below, and the different classes of membership defined:

Objects.—1. The advancement of the practical end of the foundry and the up-to-date ways and means of running same. 2. A discussion of appropriate subjects and the publication of same. 3. Education of the foremen as to the best theory and practice of molding. 4. Reducing the cost of molding. 5. The society shall neither endorse nor recommend any product consumed in foundries. 6. No foundry foreman shall be asked to advance information which would be detrimental to his employer.

Membership.—Active members shall be those who have served as foundry foremen, foremen coremakers, superintendents of foundries, or their assistants. Honorary members shall be those who are intimately connected with the foundry trade or in position to render service of value to the society.

F. C. Everitt, of New York, secretary of the Associated Foundry Foremen, explained the objects and reviewed the work of that organization, indicating the ways in which it had been of benefit to its members and to the foundry industry. Many questions were asked by Philadelphia foundrymen and by the foremen present relative to the attitude and purposes of the Associated Foundry Foremen. During these preliminary proceedings, Thos. Devlin, president of the Philadelphia Foundrymen's Association, occupied the chair.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, on Wednesday, Oct. 12. B. M. Shaw, the president, occupied the chair.

Announcement was made of the death of

Archer Brown, of Rogers, Brown & Co., who had addressed the association and was on its program for the coming winter. On motion the president appointed Messrs. Magee, Lovejoy and Snow as a committee to prepare resolutions.

The president then introduced C. H. Thomas, of Newark, N. J., president of the Associated Foundry Foremen, who gave an interesting talk on "The Casting of Iron."

After a short intermission dinner was announced, after which President Shaw introduced Thos. D. West, Sharpsville, Pa., who gave a very interesting address on: "Shrinkage Troubles and Methods of Feeding." At the conclusion of the address, a rising vote of thanks was extended to Messrs. Thomas and West. The meeting adjourned at 9 o'clock.

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry & Machine Co.

Officers for the ensuing year were elected at the monthly meeting of the Pittsburg Foundrymen's Association held at the rooms of the Engineers' Society of Western Pennsylvania on Monday evening, Oct. 3. The meeting was well attended, and after the election there was a lively discussion with reference to adopting ways and means of arousing more interest in the meeting. After adjournment lunch was served. The following officers were elected: W. H. McFadden, Mackintosh-Hemphill & Co., president; B. D. Fuller, Westinghouse Electric & Mfg. Co., vice president; J. S. Seaman, Seaman-Sleeth Co., treasurer, and F. H. Zimmers, Union Foundry & Machine Co., secretary. Executive committee: Wm. Yagle, Yagle Foundry & Machine Co.; A. W. Slocum, National Car Wheel Co.; G. C. Schade, Braddock Machine & Mfg. Co.; J. S. McCormick, J. S. McCormick & Co. Program committee, A. O. Backert, *The Iron Trade Review;* E. D. Frohman, S. Obermayer Co.; A. W. Slocum, National Car Wheel Co. The nominating committee consisted of E. A. Kebler, D. J. Thomas and J. L. McLaren.

New York Foundry Foremen.

S. M. Williams, Dist. Vice Pres., 221 Third St., Elizabethport, N. J.

The sixth meeting of the New York Foundry Foremen was held at 8 p. m., Saturday evening, Oct. 1st, at Hotel Montgomery, Jersey City, N. J. Dinner was served at the usual time, after which the evening was spent with Prof. Bradley Stoughton, of Columbia University, who gave a very interesting talk on the use of coal and coke for melting. He also described the various processes for making coke and had his talk illustrated with a number of experiments which were performed by Mr. J. F. Thompson, assistant to Prof. Stoughton. The work which Prof. Stoughton has done in getting up his course of lectures has brought together a fund of information that would be of great interest to any foundryman. The lecture was also illustrated by a number of lantern slides.

There were forty members and visitors present, and the meeting was of unusual interest. At the next meeting Mr. Stutz, of The Goldschmidt Thermit Co., will give a demonstration of their processes. Following the lecture there was quite a discussion on the use of by-product coke in foundry practice. A vote of thanks was tendered Prof. Stoughton and his assistant, Mr. Thompson, for making the meeting the most interesting and instructive since their organization, and both gentlemen were elected to honorary membership.

Chicago Foundry Foremen.

David Spence, Dist. Vice Pres., 142 Bunker St.

The Chicago Foundry Foremen held a meeting at the Grand Pacific Hotel September 19, at which a very interesting paper upon the mixing of iron by the foreman from chemical analysis furnished by an outside chemist was read and discussed.

Cleveland Foundrymen's Association.

W. H. Nicholls, 608 Gordon Avenue, District Vice-President.

The Cleveland Club of Associated Foundry Foremen have decided to change their meeting night to the first Saturday in each month, and in accordance with this held a meeting on Oct. 1. Owing to the change of time, but a comparatively small number of men were present and the regular paper of the meeting was not presented. After the informal discussion, the meeting adjourned for the first Saturday in November.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, Secretary, 2413 Third Ave., New York, N. Y., care The J. L. Mott Iron Works.

ERIE FOUNDRY FOREMEN.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

INDIANAPOLIS FOUNDRY FOREMEN.

W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

MILWAUKEE FOUNDRY FOREMEN.

Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

AN AUTOMATIC MOLDING MACHINE.

AN AUTOMATIC MOLDING MACHINE.

Many attempts have been made to produce an automatic molding machine. The one shown in the accompanying illustration is the result of a good many years of careful experimentation and work, and has now been brought to such a point that it is certainly a commercial success. In most molding machines only one or two of the operations of making the mold are actually performed by the machine, but in this machine the sand is riddled back of the machine and elevated by a bucket elevator to a suitable hopper above the machine. The pattern plate is let into an ordinary table or platen in the front of the machine, and can be changed very quickly by

simply removing a few screws, the plate being located by dowel pins. Ordinarily the patterns are placed in reverse positions on opposite sides of the runner so that the cope and the drag are alike for the setting of the sprue pins in the cope.

When operating the machine the flask and bottom board are placed in position and the lever for starting the machine is thrown. The machine automatically carries the flask to the rear, where it is filled with sand, it then travels forward and in its course is met by the bottom board, supported upon the ram, which is forced down, ramming the sand. The vibrator is immediately thrown into action and at the same time some lifting pins raise the flask off from the pattern. As the flask goes back to receive its charge of sand the bottom board is supported by suitable hooks, but as the ram comes down these hooks are drawn back so that the board remains upon the mold. All that the operator has to do is to lift the flask off and set it to one side, blow the sand from the table by means of the air hose, when all is ready for placing the other half of the flask and making the other half of the mold. The operator economizes time by placing the second half of the flask upon his machine and starting the machine before he starts to the floor with the half of the mold that has been completed. By the time he has placed the complete half of the mold on the floor, the second half has been finished by the machine, and is ready to be lifted off and carried to the floor. When using snap flasks and making light molds the mold can be assembled on a bench by the side of the machine and only one trip to the floor made. In this case the molder can have two sets of flasks and arrange it so that the machine is ramming the drag for the second mold while he is carrying the first to the floor.

When making the cope the machine is so arranged that it cuts the sprue. In fact, the machine does all the work, so that all the operator has to do is to place the flask and board in position, throw the lever, and in five seconds remove the finished half of the mold.

The pressure with which the ram presses the sand can be quickly adjusted, and as the flasks are filled automatically, all flasks are sure to be rammed alike. It is also possible to adjust the boards in such a way that the drag will be rammed harder than the cope.

One interesting point about the machine is that the pattern plates are heated by gas jets from beneath, so that the molds draw readily without the use of any parting material whatever. By the use of the proper grade of molding sand, very fine work can be made in this way without any facing, and the fact that no parting sand is introduced will greatly increase the life of the molding sand. It is also possible to fit up the machine with pattern plates quite cheaply, though, as in most similar cases, brains are required for this work.

The mistake that most parties make in putting in a molding machine is that they set the machine up, get a few pattern plates, but never give the machine a fair show. It is necessary to supply brains for this part of the foundry after the machine has been purchased, and if the original cash investment is supplemented by an investment in a good man to look after the molding machine work, there is no reason why a large amount of work now done in an indifferent manner by hand cannot be done much cheaper and better on the machine.

The machine shown in the accompanying illustration is made by the Berkshire Mfg. Co., Cleveland, O.

PERSONALS.

Mr. Chas. H. Thomas, who has been superintendent of the Hay Foundry & Iron Works, at Newark, N. J., has purchased considerable stock in the Chas. Creighton Foundry Co., located at 155th street and Eighth avenue, New York City, and has accepted a position as manager of the plant. Mr. Thomas is well known throughout the country, both as president of the Associated Foundry Foremen, and through his former connection with the Hay foundry for the past two years, previous to which time he was superintendent and manager of the Leland Faulconer Mfg. Co., Detroit, Mich. Mr. Thomas's friends certainly wish him success in his new position.

Mr. Kime I. Smith, of Providence, R. I., has accepted a position as foundry foreman with the Ruggles Machine Co., Poultney, Vt., Mr. Smith is well known among New England foundrymen and his many friends wish him success in his new position.

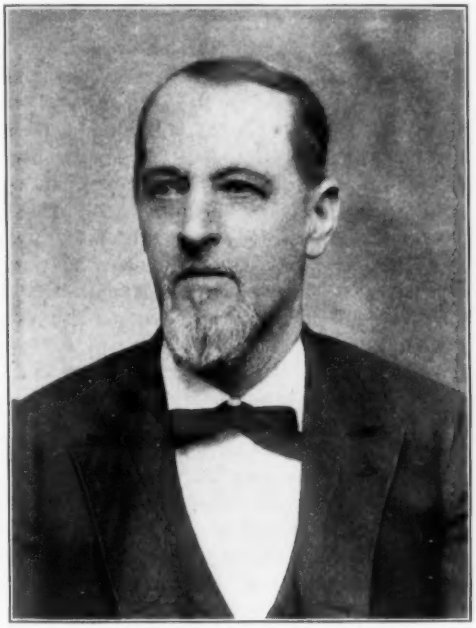
Mr. Jas. F. Webb, who for some time has been working at the brass foundry of the Lake Shore & Michigan Southern Railway, Collinwood, O., has been appointed assistant foreman of the iron foundry of the same company at Elkhart, Ind. Mr. Geo. Lemley is foreman of the Elkhart foundry, but owing to the fact that the company is planning to increase the capacity of the plant, Mr. Lemley

will need assistance. We feel that both men are to be complimented on the change. Mr. Lemley is securing a good assistant, and Mr. Webb is securing a position under such an experienced foundry foreman.

Henry E. Pridmore, Chicago, manufacturer of molding machines, who has been in Europe for his health for the last month, has just returned to his home having left Queenstown Oct. 11, on the "Ivernia."

DEATH OF J. B. RAMP.

In the October number of *The Foundry* we had a notice of the death of J. B. Ramp, and we are glad to publish a photograph and sketch of the experience of such a foundryman as Mr. Ramp was. Mr. Ramp was born in 1830 in New York City, and served his apprenticeship in Trenton, N. J., where he became foreman in the foundry where he learned his trade. Since that time he has held successively a long series of responsible positions and has met with uniform success in business.



J. B. RAMP.

He served four years in the Army of the Potomac during the Civil War, and after his return accepted a position as superintendent of the foundry of Turner & Vaughn Iron Works, Cuyahoga Falls, O. In the year 1879 work was begun on the Mississippi River locks near Keokuk, Ia., and the work required the services of a man who could produce the necessary heavy and complicated castings. It was interest in this work that induced Mr. Ramp to come West, where he spent the remainder of his life. In 1881 he became superintendent of the foundry of the Murray Iron Works Co., of Burlington, Ia., and served twenty-two years as active head of this foundry. During this time the company grew to three times its original size and capacity, and is today one of the largest and best equipped shops in the West. During Mr. Ramp's entire management of this plant he has had no labor difficulties, and the employes always considered him as their best friend. At the same time Mr. Ramp's energy, resourcefulness and careful management enabled him to conduct his work in a manner that was profitable to his employer.

Some seven or eight years ago Mr. Ramp devised a molding machine calculated to do the heavy ramming involved in the making of large molds. A description of this machine was published in the September issue of *The Foundry*. Mr. Ramp was in his 74th year at the time of his death, which came suddenly after a short illness. He was actively interested in his business up to the time of his illness. He has been instrumental in training up many apprentices who have gone out into responsible positions. Among these are his two eldest sons, Herbert M. Ramp, superintendent of the foundry of the iron department of the General Electric Co., Schenectady, N. Y., and Paul R. Ramp, superintendent of the foundry of the Wheeler Condenser & Engineering Works, Carteret, N. J.

Mr. Ramp has certainly left a record to be proud of, and will be missed by his many friends.

DEATHS.

Oliver Williams died at his home in Catasauqua, Pa., September 17. Mr. Williams was born in South Wales April 23, 1831, and when two years old was brought to this country by his parents, who settled in Schenectady, N. Y. He was educated in the common schools, and afterward attended Allentown academy for one year. He learned the trade of iron molder and worked at it until 1849, when he entered the optical establishment of McAllister & Co., Philadelphia, remaining with them until 1853, when he joined James W. Queen, one of the McAllister firm, in establishing the J. W. Queen Co. In 1855 Mr. Williams moved to

Milwaukee, where he roomed for three months with Chester A. Arthur, who afterwards became president of the United States. Mr. Arthur soon returned to New York, and while visiting him in New York in 1858, Mr. Williams met Peter R. L. Hardenberg, who proposed to go to Chicago and open a leather store, which was done. Abraham Lincoln was attorney for the firm. In 1866 Mr. Williams was appointed general manager of the Catasauqua Mfg. Co., and moved to that city, where he lived up to the time of his death. He was one of the founders of the Bryden Horse Shoe Works, of which he was president. He was also president of the Union Foundry & Machine Co. of Catasauqua. For three years he was president of the National Iron Association; for 15 years president of the Eastern Bar Iron Association and a member of the American Institute of Mining Engineers.

James L. Murphy, superintendent of the North & Judd foundry, of New Britain, Conn., died recently in Nordheim, Germany. He was for many years superintendent of foundries for J. H. Whittmore, of Naugatuck, Conn., and assumed the management of the North & Judd plant when Mr. Whittmore became financially interested in that concern.

FIRES.

The town of Moline, Ill., was visited by a severe wind storm on Sept. 26th. Among the companies which suffered losses were the Moline Scale Co. and the Union Malleable Works. At the former plant the foundry roof was blown off and one of the smoke stacks was blown down and fell across the plant. Fortunately, no one was hurt. At the Malleable plant the roof of the foundry was partially wrecked and three smoke stacks blown down.

The foundry and machine shop of Ben S. White, of Shreveport, La., was damaged by fire on Oct. 8. The company had just about completed a new shop of concrete construction adjoining the old one, but had not as yet moved into it. The new shop is not seriously damaged, but the old is almost a total loss. The loss will probably aggregate $15,000 to $18,000, about half covered by insurance.

NEW CONSTRUCTION.

The Eaton, Cole & Burnham Co., Bridgeport, Conn., is adding a building 50 x 91 ft. and two stories to its old iron foundry. The old iron foundry, together with its addition, will be used as a brass foundry.

The Sherwood Mfg. Co., Buffalo, N. Y., manufacturer of boiler and engine supplies, is now occupying its new plant. The main building is 50 x 120 ft. and includes the offices, ware and shipping rooms and tool making department on the first floor, and the brass finishing, polishing, steam testing room and nickel plant on the second floor. The converting building is 10 x 35 ft. The foundry is 50 x 100 ft. and is equipped with the latest appliances.

The Gould Mfg. Co., Seneca Falls, N. Y., have purchased forty acres of land adjoining their new plant and expect to erect a new iron foundry at once. The main building will be 500 feet in length. Later they expect to erect other buildings, which will greatly increase the capacity of their plant.

The Steubner Iron Works, Long Island City, L. I., have purchased a site and will build a foundry and mill to take the place of the plant razed to make way for the Pennsylvania tunnel.

Taylor, Wilson & Co., Ltd., founders and machinists of Allegheny, Pa., have their plans completed for and have started work on their new building at McKees Rocks, near Pittsburg, Pa. The plant will consist of a foundry 50 x 180 ft., a machine shop 100 x 160 ft., an office building and a pattern storage warehouse and other necessary buildings. The construction is to be reinforced concrete.

Davis & Thomas, of Catasauqua, Pa., are extending their foundry by erecting a new building 50 x 200 ft. of brick and steel construction. The contract for the structural work has been awarded to the Berlin Construction Co. of Berlin, Conn. The cupola capacity of the foundry will be increased 100 tons a day and the cupolas will be equipped with electric hoists and conveyors. This addition was built because of the contract for furnishing 52,000 tons of finished castings for the Pennsylvania tunnel under the East river. Orders have been placed for about $50,000 worth of special machinery for finishing tunnel rings, and 20 electric cranes of a capacity of two tons will be purchased.

The Geiser Mfg. Co., Waynesboro, Pa., is adding a foundry to the gas and gasoline engine plant at Greencastle, Pa., recently purchased.

The fire at the plant of the Chippewa Engine Works, Sault Ste. Marie, Mich., was a serious one, but the company has commenced rebuilding its machine shop and expects to have it in operation within two or three weeks. The shop will be better equipped and

more commodious than ever. The company contemplates the erection of a foundry, plans for which have been drawn. The building will be built early in the spring. Connected with the company is N. O. Flodin, who has for a number of years been connected with the Lake Shore Engine Works and has an excellent reputation in his line. The company expects to have the foundry in readiness by July or August and will be able to turn out both brass and iron castings. The machine shop will be a model one and will cater not only to the manufacture and repair of gasoline engines but everything in the line of heavy forgings and marine repairs. The officers of the company are: C. W. Baldwin, president; Simon J. Johnston, vice president and treasurer, and F. H. Hoard, secretary and general manager. Mr. Flodin will have entire charge of the foundry, drafting and pattern shop.

The Cutler-Hammer Mfg. Co., of Milwaukee, Wis., has taken out a permit for the construction of a brick veneered foundry, to cost $950.00.

The United States navy department expects to construct a new foundry in connection with their navy yards at Charleston, S. C.

The Pennsylvania Railroad Co.'s new foundry plant at South Altoona, Pa., when completed, will rank with the largest in the world and none will surpass it in modern equipment. A force of 200 men is hurrying the several buildings toward completion. They will all be nearly finished by the first of the year and it is expected that the machinery will be installed by spring. The wheel foundry is almost complete and good progress is being made on the other structures. This foundry will have a capacity of about 800 wheels per day. Two cupolas have already been erected and the power plant is nearly finished. Electricity will be the power.

H. S. Kerbaugh & Co. have bought a site of 27 acres at Marysville, Pa., on which shops will be erected for building and repairing machinery. A machine shop 340 ft. long with two annexes, a forge shop, foundry and other buildings will constitute the plant. It is expected that work on the plant will be started at an early date.

The Buckwalter Stove Co., of Royersford, Pa., has just completed a large addition to the foundry department of its extensive plant, making floor space for 90 molders. A new cupola has been installed, additional machinery has been purchased, an interior telephone system has been placed in operation and other improvements have been made. The concern was established in 1865 and has been making steady progress. Recently ground adjoining the present plant has been purchased to enable the company to build further additions when necessary. The company is now employing about 200 men. An architect has been employed to prepare plans and specifications for a six-story warehouse, 60 x 100 ft.

The Pittsburg Engineering Co., of Pittsburg, Pa., is erecting a new plant at Butler, Pa. One of the buildings now under construction will be 100 x 300 ft. and will contain both foundry and machine shop.

The Light Mfg. & Foundry Co., of Pottstown, Pa., are building an addition to their foundry to increase their foundry capacity, and also for storage purposes.

The Williams & Owens Co., proprietors of the Twin City Foundry Co., Sterling, Ill., have recently taken a contract to make all the castings for the Sterling Machine Works, and this will necessitate their building an addition to their foundry which will nearly double its present capacity.

The Tennessee Stove Works, Chattanooga, Tenn., recently organized with a capital of $50,000 which will be increased to $100,000, has purchased a tract of 4½ acres just outside the city limits of Chattanooga and ground has been broken for two large brick buildings which will be over 200 ft. in length. The plant will be in operation by Jan. 1.

The Vulcan Foundry & Iron Works, Atlanta, Ga., which was incorporated in August, has erected a foundry 50 x 90 ft.

GENERAL INDUSTRIAL NOTES.

The Addresso-Printograph Co., Elyria, O., is building a foundry and machine shop to manufacture a number of office specialties.

The Keystone Foundry Co., of Sterling, Ill., are enlarging their foundry by tearing out the partition between two of their buildings, changing the floor level and fitting up the buildings in such a way that they will increase their foundry floor area about 60 percent.

The steel department of the Peoria Steel & Tool Co., Peoria, Ill., will start with one 24-pot crucible furnace, four steam hammers varying in size from 500 to 1,000 pounds, one set of three-high rolls and a medium sized shear. There will be a small machine shop for keeping these machines in repair. The steel department will have two main buildings, each 60 x 105 ft.; a crucible room, 30 x 60 ft. and a warehouse, 31 x 60 ft. The tool department

will consist of a foundry, 60 x 60 ft. with a 10-ton cupola; a core oven and tumbling room, 21 x 44 ft.; a pattern shop, 32 x 60 ft., and a fully equipped machine shop, 60 x 120 ft. A power house and office building will also be erected.

The Eagle Novelty Mfg. Co., Chicago, has been incorporated with a capital of $10,000, to conduct a foundry and machine shop business. Incorporators are: William W. Klein, Henry H. Handlay, and John P. Chick.

The Flag Stove Works, of Camden, N. J., has been incorporated with a capital of $20,000.

The Wheeling Mold & Foundry Co., of Wheeling, W. Va., have shut down their plant for a few weeks and have a large force of structural iron workers engaged in rearranging the plant to fit it especially for handling the Penna. tunnel contract.

The Reid Bros. Co., of Bellingham, Wash., has been incorporated with a capital of $35,000, with the privilege of increasing its capital to $100,000. The trustees are: Robert A. Reid, Thomas W. Reid and Archibald McLean. The new company combines the plants of the Reid boiler works and the Bellingham Engineering Machine Co.

A pattern shop and pattern storage shop are to be built by the Babcock & Wilcox Boiler Works at Bayonne, N. J.

At a meeting of the board of directors of the National Steel Foundry Co., New Haven, Conn., last week, H. Stuart Hotchkiss was elected president to succeed Henry L. Hotchkiss, who declined re-election. The new president is the son of Henry L. Hotchkiss, and has been treasurer of the National Foundry Co. since it was organized. Other officers chosen were Frederick B. Farnsworth, vice president; Eugene Buckman, secretary, and Mirabeau Sims, manager. To fill vacancies in the board of directors, Louis H. Bristol and Eugene S. Bristol were chosen.

The Gem Stove Co., West Point, Mass., has been incorporated to manufacture stoves, grates, fronts, fenders, etc. Equipment will also be installed for manufacturing hot-air furnaces, and the company will at once arrange for the erection of necessary buildings.

The Cahill Mfg. Co., of Worcester, Mass., has recently been incorporated and will manufacture a line of brass goods for water, steam and gas fitting. Mr. J. P. Cahill is president of the company.

The Central Iron Works, Syracuse, N. Y., whose plant was recently destroyed by fire, hope to have their new buildings erected within 60 days. The new buildings will be of brick with up to date machinery.

Cunningham Bros. Foundry & Machine Shops, is the name of a new concern established at Bellefonte, Pa., by J. Mitch and Edward Cunningham, who have purchased the lot and building of the defunct Houser Springless Lock Co. Considerable new machinery will be installed.

The Contractors' Supply Co., Pottstown, Pa., has recently been organized and has leased the auxiliary casting house of the Warwick Iron & Steel Co. The old casting house is being fitted up as a foundry for making a general line of castings for contractors, railroad work, etc. Preparations are being made to do at least a portion of the casting with metal direct from the blast furnace.

The Union City Foundry Co., of Union City, Pa., has erected a foundry 70 x 110 feet, and expects to make a general line of gray iron castings, and will also make a specialty of the Barrett Sectional Cast Iron Tubular Boiler, adapted for steam and hot water heating.

When the whistle of the Stilwell-Bierce & Smith-Vaile plant, Dayton, O., was blown on the last day of September, notifying the working men that the work of the day was over, it sounded the knell of the company so far as the old name is concerned. There was no work done in the plant Saturday, Oct. 1, and work was resumed Monday, Oct. 3, under the name of the Platt Iron Works. One day's work was dropped to mark the passing of the old and the advent of the new. The new company starts under auspicious circumstances.

The Bay View Foundry Co., of Sandusky, O., which was recently chartered, is to take over the foundry business of the Sandusky Foundry & Machine Co., but it will not take over the machine department. The incorporators are: A. W. Link, J. M. Crane, A. C. Kunzman, Sidney Frohman, and George A. Blackford. Capital, $10,000.

The Treasure Stove Co., of Gallipolis, O., has been incorporated with a capital of $25,000. The incorporators are: James A. Lupton, T. A. Thomas, A. L. Bradbury, A. C. Safford, and A. F. Engle.

The new plant of the United States Malleable Casting Co., Toledo, O., has been completed and is now in operation.

The Cloverport Machine & Foundry Co., of Cloverport, Ky., have reorganized and elected the following officers: J. A. Barry, president; J. W. Pate, vice president; M. Weatherhoit, secretary and treasurer.

Work on the new machine shop of Greenlee Bros. & Co., at Rockford, Ill., has been practically completed and the moving of the equipment from the Chicago plant has been started. With the opening of the new machine shop, the company will have located in Rockford three departments of its works: the tool shop, machine shop and blacksmith shop. A foundry and small blacksmith shop will remain in Chicago for a time, but will ultimately be moved to Rockford.

The Summit Foundry Co., La Crosse, Wis., has begun operations in the property formerly occupied by the Fountain City Drill Co. The plant is being remodeled to serve the purposes of the new company in the manufacture of stoves.

The new plant of Pawling & Harnischfeger, Milwaukee, Wis., will be in operation January 1. The main building is 350 feet square and includes the bridge, erecting and machine shops. The power house is 44 x 105 ft., and the foundry is 108 x 150 ft. with side extensions for storage purposes. The pattern shop and pattern storage house are each 50 x 165 ft., one and three stories high, respectively, and of slow burning mill construction. The office building is 60 x 75 ft., three stories. All foundations are concrete, with walls of brick and structural steel. The machinery of the old plant will be transferred to the new works as soon as these are completed. The new equipment needed has been ordered.

The Trenton Hardware Mfg. Co., Trenton, N. J., has been organized with a capital of $50,000, $10,000 of which is paid in. They expect to make a full line of builders' hardware. The president of the company is Walter Emmons, who was recently manager of the Billingham Foundry Co.

The Savannah Pipe & Foundry Co., of Savannah, Ga., has been incorporated with a capital of $10,000, and the privilege of increasing its capital to $50,000. They intend to manufacture pipe and carry on a general foundry business. The incorporators are: John F. Freeman, James H. McKenna, Thomas G. Philpot and U. H. McLaws.

Geo. L. Hoffer has secured an interest in the Laurel Foundry & Machine Co., of Laurel, Miss., and will add an iron foundry.

The first castings were made by the Iowa Malleable Iron Co., Fairfield, Ia., last week. The main foundry of its plant is 106 x 142 ft.; the cleaning room 12 x 108 ft.; shipping and annealing rooms 86 x 118 ft. The buildings are well constructed with concrete foundations with four and one-half feet of brick wall, pressed steel siding and asphalt roofing. The foundry will have 64 molders and will use 24 molding machines. The company has a large number of orders on hand.

The Iowa Foundry Co., Sioux City, Ia., is about to begin operations in its newly acquired plant. All of the members of the company are skilled foundrymen.

The Vancouver Pipe & Foundry Co. has been organized with a capital of $10,000, to take over the business of Wharton & Grey, of Vancouver, B. C.

A two-ton Tropenas converter is being installed by the Massachusetts Steel Casting Co., Everett, Mich., successor of the United States Steel Co. The open-hearth plant, consisting of two 15-ton furnaces, will be improved and will be ready for operation about Jan. 1.

The Lawrence Pump & Engine Co., of Lawrence, Mass., has been incorporated with a capital of $24,000. The officers and directors are: President, Hiram L. Mellor; treasurer, Francis A. Hall; clerk, Percy Hall, all of Lawrence, Mass.

The Gravity Iron Works is the name of the new company which has been organized at Carbondale, Pa. They will take over the plant of the Carbondale Metal Working Co., and carry on a general foundry and machine shop business. The incorporators are: John M. Kemmerer, Benton T. Jayne, Chas. S. Jacobs, and T. R. Hughes, of Scranton, Pa., also Chas. Raine and Daniel Slowe.

The Electric Smelting & Aluminum Co., of Cleveland, O., have purchased the Cowles Electric Smelting & Aluminum Co., of Lockport, N. Y. The Cowles Co. has been carrying on the business as a licensee under the patents of the Cleveland company for the past nine years and the present purchase is in the nature of a consolidation, facilitating the carrying on of the business, the Cleveland company being formed with practically the same stockholders which controlled the stock of the Cowles company.

The National Foundry Supply & Equipment Co., of Cleveland, O., has been incorporated with a capital of $20,000.

The manager of the Jeffersonville, Ind., plant of the American Car & Foundry Co. has received orders to close the plant for an indefinite period.

S. B. Robertson, Mount Holly, N. C., is in the market for complete equipment of machinery for a new foundry.

The Standard Stove Works, which recently erected a plant at Columbus, Miss., are now operating with a working force of 60 molders. The plant has a capacity of 150 cook stoves a day, which the company states are sold ahead for 30 days.

The property of the Southern Foundry & Machine Co., Knoxville, Tenn., has been sold at public auction to W. S. Bradley, one of the stockholders, for $16,600.

Frank Runser, formerly manager of the Mahoning Foundry & Machine Co., has secured interests in the Forsythe Pattern Co., of Youngstown, O., formerly held by Mr. Forsythe. Mr. Forsythe has been in poor health for several months and has purchased a farm in Maryland, where he intends to reside and devote himself to agricultural pursuits for the present.

The Singer Co. have awarded a contract to Jas. Stewart & Co., of Pittsburg, for the erection of some of the buildings of their new $1,000,000 plant at St. John's, Province of Quebec, Canada. Among the buildings to be constructed are a foundry 100 x 400 ft., with two wings, one 40 x 70 and one 54 x 60, one of which is to be used as a cupola room and the other as a core room, also a foundry shed 75 x 200 ft. and pattern storage house 60 x 60 ft., together with other buildings for pattern shop, machine shops, woodworking plant, etc.

TRADE PUBLICATIONS.

The New York Belting & Packing Co., Ltd., with offices at 91-93 Chambers street, New York, and 724 Chestnut street, Philadelphia, have issued a folder describing some of the various forms of packing manufactured by this company and setting forth the various advantages of these grades.

Dean Bros. Steam Pump Works, of Indianapolis, Ind., have issued a catalogue 6 x 7¼ in., entitled Dean Bros. Condensing Machinery, in which they describe various types of condensing apparatus manufactured by them and give a large amount of information concerning condensing machinery, that should be of interest to all who have condensing problems to solve.

The American Blower Co., of Detroit, Mich., have issued a catalogue 7 x 9 in., entitled A B C vertical engines, Type A, in which they illustrate and describe this class of engines manufactured by them.

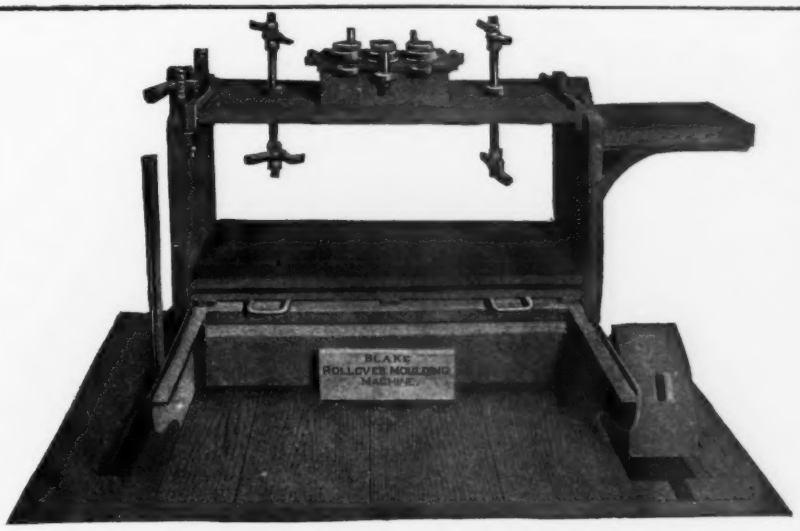
The Atlas Car & Mfg. Co., of Cleveland, O., have issued a catalogue 9 x 6 in., containing 100 pages, in which they illustrate and describe various types of dumping and light cars for narrow gauge tracks made by them. They also illustrate slag and metal ladles for hot metal, core oven racks and cars, turn tables, transfer tables, and railroad track specialties such as frogs, crossings, etc. This catalogue should prove of especial interest to any foundrymen who are installing new plants or new handling facilities.

The Rand Drill Co., of 128 Broadway, N. Y., have issued a circular describing the Imperial pneumatic tools manufactured by them. The circular contains illustrations of the tools in use for many purposes, showing how they can be used in confined places, and gives facts and figures relating to them.

Geo. G. Blackwell, Sons & Co., Ltd., of Liverpool, England, have issued a circular entitled "Globe Brand Graphite," describing this company's graphite products. Like all publications of this company it is of uniform size, 4 x 5½ in., is very neatly printed and contains short, clear statements concerning the products.

The Hancock Inspirator Co., with offices at 85-89 Liberty street, New York City, and 22-26 So. Canal street, Chicago, Ill., have issued a new catalogue 9 x 6 in., which is not only a remarkably good example of the printer's skill, but contains a considerable amount of extremely interesting reading. Of course the body of the catalogue describes their goods, as every good catalogue should, but in the first part they have an interesting description of the plant where the goods are made and something of a sketch of the history of the company. This portion of the work is interesting, not only from the insight it gives into the careful methods pursued by this company, but also from the fact that any one interested in manufacturing lines can always glean many points of interest from the perusal of such a description.

The Bristol Co., of Waterbury, Conn., has issued a catalogue describing the Bristol volt, ampere and watt maters. This catalogue, however, is 9 x 12½ in. and hence is rather awkward to file or take care of in any ordinary office system. The catalogue contains, however, a very large amount of interesting matter in the shape of charts, tables, etc., and shows how these instruments can be applied for the control or recording of various facts about a manufacturing plant.



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You can use your ordinary patterns on this machine: ordinary flasks or snap flasks. The machine is simple, and easily adjusted, and particularly adapted for small work. Find out what work you have got, and write us, and we will furnish you a molding machine at a low cost that will turn your plant into a "money maker." The accompanying cut shows the Blake Roll-Over Molding Machine, complete with levers and balancing work. In operation in our own foundry, this machine produces castings with less loss than either a full pneumatic or automatic or stripping plate machine.

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43

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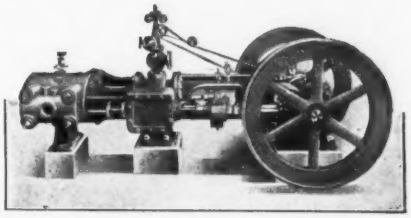

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